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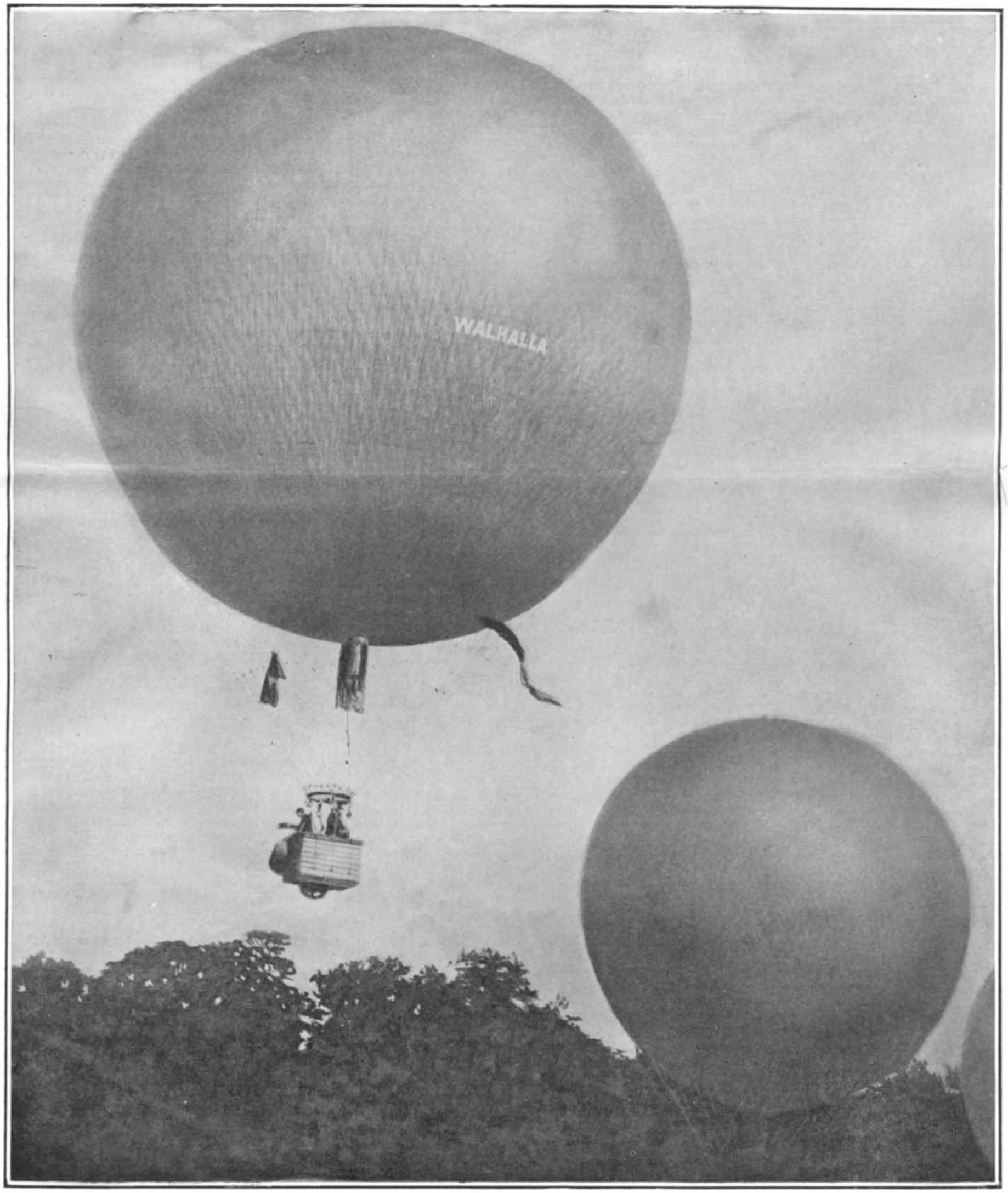
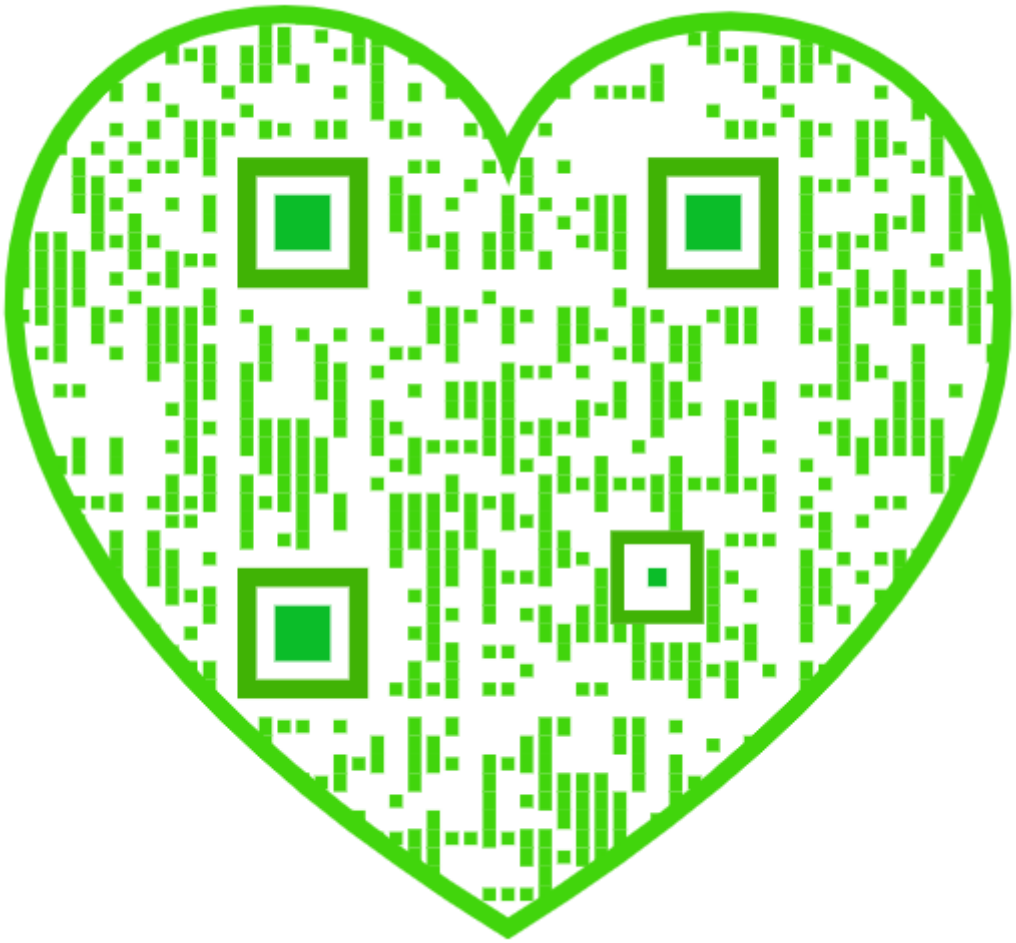



COUNT DE LA VAULX STARTING WITH THE "WALHALLA" IN THE INTERNATIONAL BALLOON RACE.—[See page 300.]



# SCIENTIFIC AMERICAN

**ESTABLISHED 1845**

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NEW YORK, SATURDAY, OCTOBER 27, 1906.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.


## OUR VAST RAILROAD SYSTEM.

The era of extraordinary prosperity now being enjoyed by the United States is reflected in the stupendous railway system which has contributed so largely to that prosperity. We have in this country, as recorded in the latest available figures, a total single-track railway mileage of 218,101 miles. This is an increase of 4,196 miles over the year preceding. The aggregate length of mileage, including sidings and tracks of all kinds, is 306,796 miles, which is owned by no less than 2,167 railway corporations. The equipment includes 48,357 locomotives, an increase during the year of 1,614; while the total number of cars is 1,842,871, an increase of 44,310 during the year.

It is gratifying to note that the work of the Interstate Commerce Commission in enforcing the use of train brakes and automatic couplers has been so successful, that out of an aggregate number of 1,891,228 locomotives and cars, 1,641,395 are fitted with train brakes, and 1,871,590 have automatic couplers. To operate the railroads requires the services of 1,382,196 employees; and the total amount of wages and salaries paid out during the year was $839,944,680. The par value of the amount of railway capital outstanding is nearly thirteen billion dollars, and of the total capital stock 37.16 per cent paid no dividends. Of the balance of the stock 9.72 per cent paid from 1 to 4 per cent; 14.77 per cent from 4 to 5 per cent; 10.74 per cent from 5 to 6 per cent; 8.79 per cent paid from 6 to 7 per cent, and 11.68 per cent paid 7 to 8 per cent.

The number of passengers carried by the railways was 738,834,667, an increase of over 23 million during the year. The number of tons of freight carried was 1,428 millions, an increase during the year of nearly 118 million tons. The gross earnings were for the first time over two billion dollars, while the operating expenses were $1,390,000,000.

In the annual reports made to the Interstate Commerce Commission, carriers are expected to include all casualties to passengers, employees, trespassers, and other persons; and the totals as compiled by the Commission show that the total number of casualties to persons on railways for the year ending June 30, 1905, was 95,711, which was made up of 9,703 persons killed and 86,008 injured. Among the employees 1,990 trainmen were killed and 29,862 injured; 136 switch tenders, watchmen, etc., were killed and 838 injured; while of other employees, 1,235 were killed and 36,097 injured. The risk due to the work of coupling and uncoupling cars accounts for 230 lives and 3,543 injuries. The number of passengers killed in the same year was 537, and the number injured was 10,457. In addition to these figures we find that no less than 4,865 people were killed and 5,251 were injured while trespassing on railway property; while of persons other than employees, 4,569 were killed and nearly as many injured by being struck by trains, locomotives, or cars. In applying the test of risk in proportion to numbers, we find that one passenger was killed for every 1,375,856 carried, and one injured for every 70,655 carried. When we apply the same test to the employees, the results are exceedingly discouraging and positively tragic, for we find that one out of every 133 trainmen, that is, engineers, firemen, conductors, and other trainmen employed, is killed and that out of every 9 employed one is injured.

## A BRILLIANT NAVY YARD SUCCESS.

It is now some half dozen years or more since Francis P. Bowles, the late Chief Constructor of the United States Navy, made the startling proposition that it would be advisable for the government to undertake the construction of some of its warships at the leading navy yards. The proposal was bitterly opposed, ostensibly on the grounds that some of our early, government-built warships had proved to be exceedingly costly; that they had taken a long while to construct; and that they had not proved to be altogether satisfactory in service. Mr. Bowles replied that those ships were built at a time when the navy yards were smitten with the blight of political interference; that the yards had now been emancipated from politics; and that they were in a thoroughly efficient condition, and were fully competent to build warships expeditiously and, within the limits of the shorter hours and higher wages paid, to build them economically.

The SCIENTIFIC AMERICAN, after a careful investigation of conditions, reached the conclusion that the suggestion to build some ships at the navy yards was an excellent one, the arguments offered in favor of the policy being unanswerable. At that time the private contractors who had warships on hand were showing a deplorable lack of regard for the nation's interests, by allowing work on the war vessels to drag along in any old fashion, and it was largely in the hope that the stimulus afforded by the construction of government vessels in government yards would prompt the private shipyards to live up to the spirit and letter of their contracts, that the proposal was put forward. But over and above this consideration was another and not less important, namely, that if such a navy yard as that at Brooklyn were occupied in the construction of a warship, it would be necessary to keep a large and skilled force of mechanics constantly at work, and there would not be that continual fluctuation in the number of men employed, which had been one of the severest drawbacks to efficient work when the yard was engaged merely upon repairs and refitting. Under the old regime, the work of the yard consisted almost entirely in the refitting of the fleet twice a year, in June and November. A large number of extra hands had to be temporarily taken on, only to be discharged again when the fleet sailed for its summer or winter cruise. Frequently, it proved to be difficult to gather a sufficient force of the kind required, and it took some little time to break the men in thoroughly to work which, to many of them, was of a novel character. It was urged that if a warship were on the stocks it would be possible to keep a force of large proportions permanently in the yard, and that when the fleet came in for refitting, these men could be transferred from construction to repair work, and returned to construction work when the fleet left the yard.

It is a matter of history that Congress was led to see the wisdom of the course proposed, and that when the 16,000-ton "Connecticut" and "Louisiana" were authorized, it was decreed that one of the ships should be built at a government yard. It is also a matter of history that the "Connecticut," which was laid down at the Brooklyn navy yard, has been built in the record time of three years and nine months, and that the pace she set was followed by the private yard which was building the sister ship, both of these vessels being completed at practically the same time. This time should be compared with the time taken in the construction of earlier battleships, of only two-thirds the size, which had taken from five to six years to build.

The "Connecticut" has thus amply fulfilled the promise made as to speed of construction; and there is no question that the stimulus thus afforded will be permanent. It was realized at the outset that, because of the fact that navy yard employees work shorter hours and receive higher pay than those at private yards, the vessel must, of necessity, cost more than if she were built by contract. The difference was estimated at ten per cent, an amount which is more than repaid in the military advantages of having on hand at all times an efficient force of men. Although the final estimate of the cost of the two vessels has not yet been made up, enough is known to guarantee the statement that the "Connecticut" has cost less than was estimated, that is to say, that she has been built well within the ten per cent excess that was anticipated.

We have noticed that in certain quarters there is evidence of a desire to disparage the work done at the navy yard, and assert that the "Connecticut" has cost more than was anticipated and has taken very much longer to complete. Therefore we now wish to state the facts as recorded in the government official reports of the two vessels, which have already appeared in the public press. Last April, when the "Connecticut" was slightly ahead of the "Louisiana," both ships being between 97 and 98 per cent completed, the appropriation had been all expended, and work was stopped on the "Connecticut" for the reason that the ordnance, which was being supplied to both ships by the government, was lacking. For this reason, from April to July, nothing whatever was done on the "Connecticut." In order, however, to save demurrage charges in the case of the contract-built ship, the government decided to accept the "Louisiana" in her incomplete condition. Consequently, although in the government report for July the "Connecticut" is given as only 97.41 per cent completed, the "Louisiana," having been accepted, is given as 100 per cent completed; but at the foot of the report is a note to this effect: "The percentage of completion refers to contract work, which in the case of the 'Louisiana' has been modified so that the installation of the battery is to be completed by the government." When the belated 7-inch battery was delivered to the "Connecticut" in the summer, the work incidental to mounting the battery was pushed to completion, and the ship recently went into commission. It is well known to government officials that, in regard to minor fittings and general finishing up, the "Connecticut" is as a matter of fact in a slightly more advanced condition than the sister ship. Not so much because we advocated strongly the construction of one or two warships at the navy yards, as because we have the interests of the navy most sincerely at heart, we take the present opportunity of presenting the true facts of the case to the public, with the hope that, at least as regards our two leading yards, the policy of government construction will be continued.

The argument has lately been advanced by those who are opposed to government construction, that the navy has grown to such a size that there are sufficient ships at the navy yard at all times to keep a large force permanently employed. While it is true that the permanent force is larger, it is also true that the fluctuation in the force is much greater than it ever was before. Therefore, the arguments in favor of having at all times a large job of new construction on hand are stronger than at any previous time in the history of the navy. Proof of this is shown by a comparison of the number of ships in the yard for repairs on June 14 of this year with the number in the yard on October 1. In June the Atlantic fleet was at the Brooklyn navy yard for extensive repairs and refitting. Work was being done on five battleships, the "Indiana," "Massachusetts," "Maine," "Alabama," and "Illinois," while work would have been going on upon the "Connecticut" had the supply of 7-inch guns been available. Repairs and refitting were being done also on five of our largest armored cruisers, the "West Virginia," "Charleston," "Colorado," "Pennsylvania," and "Maryland," and also upon four auxiliary vessels, the "Portsmouth," "Culgoa," "Celtic," and "Celt," and last upon the submarine "Plunger."

From sixteen vessels at the yard in June the number had fallen to five on October 1, namely, the battleships "Connecticut" and "Massachusetts," the yacht "Mayflower," and the auxiliaries "Culgoa" and "Aberenda." Such fluctuating conditions as these involve a variation in the total force of the yard from a maximum of 6,000 at the time that the "Connecticut" was under construction, to a total of from 3,000 to as low as 500 when, as in October, there is no warship on the stocks and but little work is being done on the vessels that are there.

The above comparison is sufficient proof, surely, that the construction of at least one ship at our leading yard is eminently desirable; for not only does the employment of a permanent force lead to great economy and efficiency in the work done, but it puts the yard in the best possible condition to meet the sudden emergency, which will always arise during a war scare, or upon the actual outbreak of hostilities.

## THE SHAPE OF THE SUN.

That there is a variation in the figure of the sun has long been suspected. Observations apparently confirming this variation have been recently published by Ambronn embodying heliometer measures made with the Göttingen heliometer during 1890-1902. Schur determined a series of measures of the solar diameter throughout the whole of a sun-spot cycle of eleven years or thereabout, and, to obviate errors as far as possible, two complete and independent series of observations were made by himself and Ambronn. In their discussion Ambronn found the mean solar diameter for the whole series; then the residual for each observation by subtracting the mean. From these residuals he obtained the mean residual for each year, and thus the yearly variation in diameter. The table of these variations shows a periodicity with a time of between six and eight years.

C. L. Poor, in an article appearing in the Astrophys. Journal, considers that this method could not lead to the detection of any changes in the diameters, and rediscusses the whole series of values. He detects a decided periodicity, the polar diameter being larger in 1890-91, while the equatorial diameter was greatest during 1892, 1893, and 1894. The exact length of the period is uncertain, but it appears to be nearly the same as the sun-spot period. The amplitude of the variation is 0.2 sec., the difference between the largest positive and negative values being about 0.5 sec. These heliometer measures thus corroborate the conclusions previously determined from Rutherford's photographs, but the amplitude of the variation is much less in the case of the visual observations.

Since 1878 to the present time nearly every year has seen a continued and steady decline in the amount of rainfall in Ecuador. No exact statistics are obtainable, but there is little reason to doubt that the decline within the period cited is upward of 30 per cent.

## THE HEAVENS IN NOVEMBER.

BY HENRY NORRIS RUSSELL, PH.D.

Though the days are growing colder as the sun gets farther south, and we receive less of his light and heat, we are nevertheless some 600,000 miles nearer the central fire of our system at the end of November than at the beginning.

It may be asked, How do we know this? What evidence have we that the earth's orbit is not a circle, with the sun in the center?

The simplest and most direct proof that the sun is not always at the same distance from us is that its apparent diameter varies. It looks bigger in winter than in summer, to the extent of fully one-thirtieth of its whole diameter. The only reasonable explanation is that it must be nearer us in winter than in summer, by one-thirtieth of its whole distance. If we supposed that its distance did not change, we would have to believe that the sun's actual diameter changed by about 30,000 miles during the year—which is altogether incredible.

These variations in the apparent size of the sun are, however, too small to be discovered without telescopic aid, and hence remained unknown to the ancients. They can, however, be plainly shown by measurement even with a sextant, and with instruments of higher precision they become very conspicuous. A series of solar photographs taken with the same instrument in a fixed adjustment would convince anyone who examined them that the sun seems to grow smaller all through the first half of each year, reaches its smallest in July, and then gradually increases till it exactly regains its original diameter.

This demonstrates that the sun is not in the center of the earth's orbit, but does not prove that the orbit may not after all be a circle with the sun out of the middle. To do this takes more delicate observations. The ellipse in which the earth actually moves is so nearly circular that it would be possible to draw a circle (with its center more than a million miles from the sun) which would never be more than 7,000 miles distant from the real orbit. By assuming that the earth moved in such a circle, we could account fairly well for the observed motions of the sun and planets; but when it comes to modern observations with their high accuracy, the error of 7,000 miles in our assumed position would make our calculations differ from our observations by amounts many times as large as the errors of the latter. In the case of some of the other planets, the errors would be much larger. For example, it is impossible to draw any circle which does not at some point deviate more than 300,000 miles from the orbit of Mars. In fact, it was the failure of all his attempts to represent the motion of Mars by means of a circular orbit that led Kepler to the discovery that its orbit, and those of the other planets, were elliptical.

In addition to all these reasons, we know that the law of gravitation demands that the orbits of the planets shall be conic sections. The proof of this proposition is not regarded as difficult by mathematicians, but as it involves the methods of the calculus it cannot well be presented in a popular article. The law of gravitation, however, is perfectly consistent with the existence of circular orbits of any size, for a circle as well as an ellipse is a conic section. Whether the planets' orbits are elliptical or not, and how their eccentricity, can be determined only by on this point observation speaks de- all elliptical to a greater or less

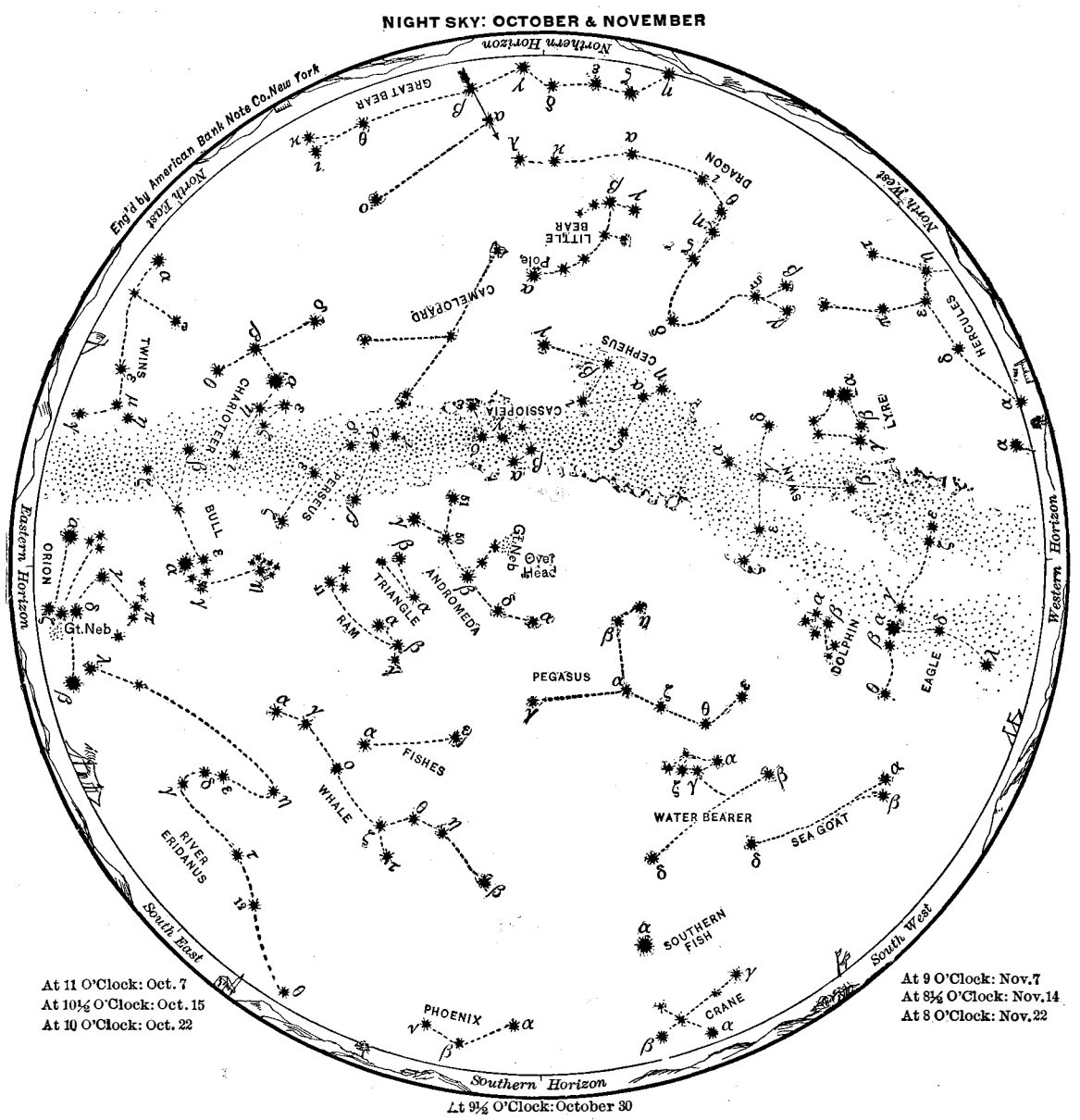
THE HEAVENS.

map, we see that the principal western sky are the Eagle and Swan high up above them. The sus is on the meridian close to the zenith. Below it in the southwest are the Goat (Capricornus) and Aquarius the Water-Bearer, and still lower is the bright star Fomalhaut in the Southern Fish.

The Crane and the Phœnix are southern constellations, which we never see to advantage. This remark applies with somewhat less force to Eridanus, a very large constellation whose brightest star, Achernar, never rises above our horizon. Between Eridanus and Pegasus is another very large group—Cetus the Whale. Its principal stars are shown on the map. The star $\tau$ is one of our nearest neighbors (its distance being about ten light years) and $o$ Ceti is the famous variable Mira, which is now approaching its maximum, at which it is one of the brightest stars in the constellation, while at minimum it is of the ninth magnitude, invisible without a telescope.

Orion is rising in the east, and Taurus the Bull is above him with its two prominent star-groups—the Hyades, which contain the bright red Aldebaran, and the Pleiades.

Andromeda is right overhead with Aries the Ram to the southeast. In the Milky Way, beginning in the northeast, we have the Twins (Gemini), the charioteer (Auriga), with the great yellow star Capella, then Perseus, Cassiopeia, and Cepheus. Below these are the Little Bear and the Dragon, and still lower down along the northern horizon is the familiar form of the Great Bear.




In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed; counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

THE PLANETS.

Mercury is evening star in Libra and Scorpio, but is so far south that he will not be well seen in our latitude. Even on the 9th, when he is farthest from the sun, he sets less than an hour after sunset. On the 29th he passes between us and the sun, and becomes a morning star.

Venus behaves in just the same manner as Mercury this month, being evening star till the 29th, and then becoming a morning star. She is extremely far south, and will not be conspicuous, even at the beginning of November.

Toward the end of the month she will be visible only in the daytime in telescopes provided with circles which enable them to be set exactly on the planet. She will be a very interesting object for those who can see her, for she passes almost exactly between us and the sun—apparently about 1½ degrees south of him. Under these circumstances the twilight in Venus's atmosphere produces an elongation of the horns of her crescent, so that it covers three-quarters or more of the circle. Under the most favorable conditions the horns may meet, and the planet appear as a ring of light. This phenomenon will occur on the 29th of November, and may be observable if the weather is clear enough. As it is of rare occurrence, it is mentioned here for the benefit of anyone who may care to look for it. The principal difficulty is to keep the direct rays of the sun out of the telescope, but a little ingenuity will provide a suitable screen. We will return to the subject in December. Mars is morning star in Leo, rising at about 2 A. M. Jupiter is in Gemini, and is fast becoming conspicuous in the evening, as he approaches opposition. He rises at about 8:30 P. M. on the 1st and 6:30 on the 30th. Saturn is in Aquarius, about 25 deg. south of the great square of Pegasus. He crosses the meridian about 7 P. M. in the middle of the month, and is visible all the evening. Uranus is in Sagittarius, and sets at about 7 P. M. on the 15th, so that he is hardly observable. Neptune is in Gemini and rises about 8 P. M.

THE MOON.

Last quarter occurs at 4 A. M. on the 9th, new moon at 3 A. M. on the 16th, first quarter at 7 P. M. on the 22d, and full moon at 6 P. M. on the 30th. The moon is nearest us on the 16th, and farthest away on the 4th. She is in conjunction with Jupiter and Neptune on the 6th, Mars on the 13th, Mercury and Venus on the 17th, Uranus on the 19th, and Saturn on the 23rd. The conjunction with Jupiter is pretty close.

Princeton University Observatory.

## RECOVERING METALS MELTED IN THE SAN FRANCISCO FIRE.

BY ARTHUR INKERSLEY.

After the great San Francisco fire, hundreds of tons of lead, zinc, and other metals owned by the Selby Smelting Company were found melted into a solid block at the base of the shot tower that was for many years one of the landmarks of the old city.

The problem of recovering the metals, which were worth many hundreds of thousands of dollars, was a difficult one. The great mass could not be raised or broken up into fragments of a practicable size by any ordinary means. A method has, however, been found by which it is hoped to recover the valuable metals.

After removing several tons of bricks and débris, channels have been cut through the great block of metal by an electrical arc process. The bed of metal is from three to four feet thick, and covers the entire area of the ruins of the tower. The heat and light produced by the process are intense, though only ten volts are used for each implement. The men who are engaged in cutting the channels have their heads and faces covered with canvas to protect them from the blinding light. Large blocks have been cut away from the great pile, and it is expected that the whole work will take up the winter. About two hundred tons of lead, zinc, and tin still remain to be recovered. The work, which is being done by the Dwyer-Frickey Electrical Company, is of so unusual a character, that it is constantly watched by a crowd of interested people. The metal is recovered in blocks weighing nearly a ton each.

## SIR RICHARD TANGYE.

Sir Richard Tangye, head of the engineering firm of Tangyes, died on October 14. He was born in 1833. Tangyes have establishments in London, Birmingham, Johannesburg, Sydney, and other cities. Sir Richard, with his brother, George Tangye, founded the Birmingham Art Gallery and Municipal School of Art. His hobby was the collection of manuscripts, books, and other relics of the period of Cromwell and the Commonwealth. He wrote several books, including "Reminiscences of Travel in Australia, America, and Egypt," "The Growth of a Great Industry," and "The Two Protectors." He owned estates in Surrey and Cornwall.

## THE FIRST INTERNATIONAL BALLOON RACE.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

BALLOONING as a sport received a great impetus as a result of the recent international race for the cup offered by Mr. James Gordon Bennett. Sixteen great balloons representing seven different nations, each one having been selected, both as to the material and the champions, with the greatest care by the aeronautic clubs in the respective countries, took part in the race. Founded on about the same lines as the Automobile Cup Race, the present contest was to be an annual one. Each aeronautic club selects its champions, and has the right to enter three balloons or any other form of aerial flier. The International Aeronautic Federation organizes the events each year and receives the entries, and the race is held in the winner's country. The present event being the first one of the kind, it was decided to hold it in France, under the direction of the Aero Club.

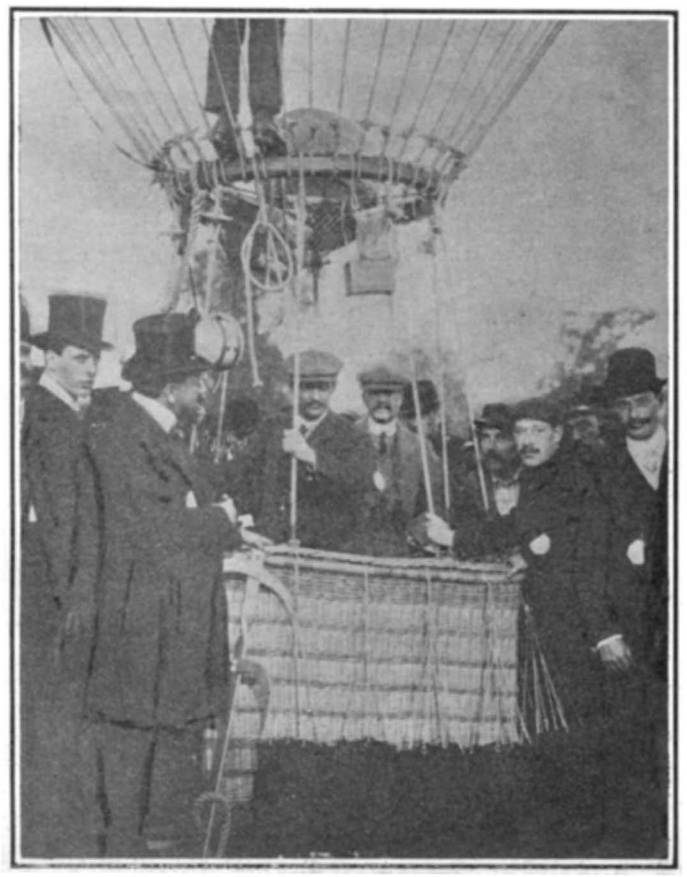
The balloon which covers the longest distance wins the cup for its club during that year, and should the club be a winner three times in succession, it holds the cup as its property. Mr. James Gordon Bennett offered the handsome work of art which is illustrated here, having a value of $2,500. It has been executed in silver by the Aucoc firm of Paris, from the design of Leon Pilet and Robinet, and represents an airship led by a winged genius bearing a torch. While the Cup can become the property only of an aeronautic club, the winning pilots will receive a number of prizes in person, and the first prize for the cup-winner is $2,900, representing the fixed amount of $2,500 and one-half the engagements. The second and third prizes are $270 and $135 respectively. Many other recompenses in the form of medals are awarded, including the gold medal of the Aero Club of Southwest France, the Sports medal, the Auto medal, meteorologic prizes, medal of the Aero Club of France, and others. Joined with the present event is the Gaulois cup for distance, also the Santos Dumont prize of $800 for the first aerial voyage of 48 hours. The record for distance to be beaten is 1,195 miles, made by Count de la Vaulx in 1900, from Paris to Korostychew, Russia.

Seven different nations were represented in the contest this year: Germany by the Deutscher Luftschiffer Verband, America by the Aero Club of America, Belgium by the Aero Club de Belgique, Spain by the Real Aero-Club de Espana, Great Britain by the Aero Club of the United Kingdom, Italy by the Societa Aeronautica Italiana, and France by the Aero Club of France. The champions, whose names are given below, were chosen from among the most prominent aeronauts in each country, most of them having a long experience in ballooning. With such strong teams as these, the contest promised to be an exciting one. America had entered Santos Dumont and Lieut. Frank P. Lahm, and the latter was successful in carrying off the cup. Lieut. Lahm was graduated from West Point as a cavalry lieutenant, and after a two years' campaign in the Philippines, re-entered the Academy as instructor. Devoting his attention to aeronautics, he soon became prominent in such events and made many fine ascensions. Having come to France in order to take a military course at the Saumur Academy, he continued ballooning in France with great success. With him in the car was Major Hersey, well known as an officer of the Weather Bureau, who is also second in the Wellman Polar Expedition. The start took place at four o'clock precisely. First to lead off was the "Elfe," mounted by the aeronaut Von Willer, the Italian champion representing the Societa Aeronautica Italiana. The balloon left the ground when the word was given, and amid great cheering it rose slowly above the grounds of the Tuileries. A rather strong wind was blowing to the west, and the balloon took this direction at once, mounting on an inclined path. It soon rose to a considerable height, at the same time being carried out of sight in the direction of the wind. The other balloons followed, at intervals of five minutes. The start was well managed by the military and civil equipments, and each competitor was brought into place at the starting point with great precision. As soon as one balloon rose up from the ground, a second, which had been already placed near by, was carried upon the spot and was soon ready to leave. Next followed the German balloon "Düsseldorf," the French equipment on the "Walhalla," and the rest of the competitors as will be seen in the following list:

(1) Italy: Pilot, M. Alfred Von Willer; aid, Lieut. E. Cianetti, upon the balloon "Elfe." (2) Germany: Pilot, Capt. H. Von Abercron; aid, M. Oscar Erbslöh, on the "Düsseldorf." (3) France: Count Henry De la Vaulx and Count D'Oultremont, on the "Walhalla." (4) Spain: Lieut. E. Herrera and aid, upon the "Ay-Ay-Ay." (5) Great Britain: Hon. C. S. Rolls and Col. Capper, on the balloon "The Britannia." (6) America: Pilot, Santos Dumont, with his mechanic Chopin, the "Deux Ameriques" provided with two propellers. (7) Belgium: M. Van den Driesche and L. Capazza, on a balloon which replaced the "Ojouki." (8) Germany: M. Scherle and Dr. Schmeck, on the "Schwaben." (9) France: Count Castillon de Saint-Victor and Ernest Zens, upon the "Foehn." (10) Spain: Pilot, M. G. de Salamanca; aid, M. Montojo, on the "Norte." (11) Great Britain: "The City of London," mounted by F. Hedges Butler and P. Spencer. (12) America: Lieut. Frank P. Lahm; second, Major Hersey, mounted on the balloon "United States." (13) Germany: the "Pommern," piloted by Baron Von Hewald and Dr. Steyrer. (14) France: M. Jacques Balsan and Abel Corot, on the "Ville de Chateauroux," provided with an interior ballonnet. (15) Spain: Pilot, Capt. Kindelan y Duani; aid, De la Horga, on the "Montañer." (16) Great Britain: the "Zephyr," Prof. A. K. Huntington and Mr. Pollack.

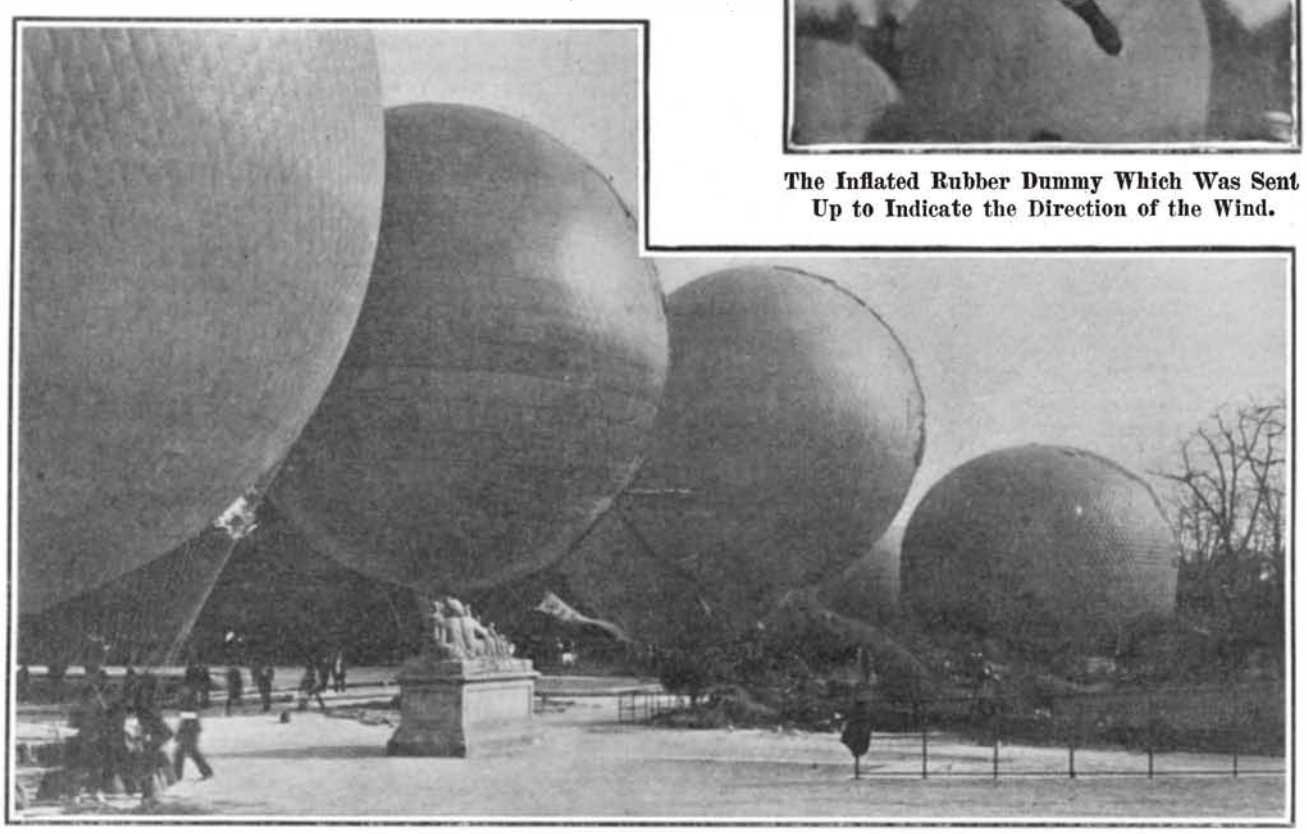
The result of the race and the part of the continent to be covered by the balloons depended naturally upon the direction of the wind, and this was far from favorable. Although the sky was clear, and the other conditions reasonably good for this time of year, the wind drove the balloons toward the north, taking them to the Channel coast of France, and the aeronauts were obliged to decide whether they would risk crossing the Channel during the night, or whether they would stay on this side. Landing on the coast of Normandy, many of them were not familiar with the country, and not finding their bearings, feared to cross as they supposed they would be carried out upon the Atlantic. Seven of the balloons crossed the Channel and sailed over the south and east of England. None of them went farther than that, as the aeronauts who reached the coast of the North Sea thought it was not advisable to cross, as they would no doubt be under a great risk, and might be even driven back on the coast of Holland.

Lieut. Frank P. Lahm succeeded in reaching Flyinghall, in Yorkshire, which was the point farthest north, and he thus won the cup, having covered the distance of 395 miles from the starting point in a straight line. He remained 22 hours 28 minutes in the air. Next came the Italian champion Von Willer, who landed also in Yorkshire at New Holland, making the distance of 360 miles. Count de la Vaulx, the French aeronaut, and C. S. Rolls, the English champion, both made about the same distance, one landing at Walsingham and the other at Sandringham, Norfolk. The distance [illegible] is near 290 miles. Next came Prof. [illegible] England, with 210 miles, landing [illegible] Kent; Jacques Balsan, France, at [illegible] 204 miles; and Capt. Kindelan, Sp[illegible] chester, 198 miles. The rest of the [illegible] not cross the Channel landed ve[illegible] or near the coast of Normandy. [illegible] loons which entered the race,



C. S. Rolls the English Aeronaut. His Record Was 290 Miles.

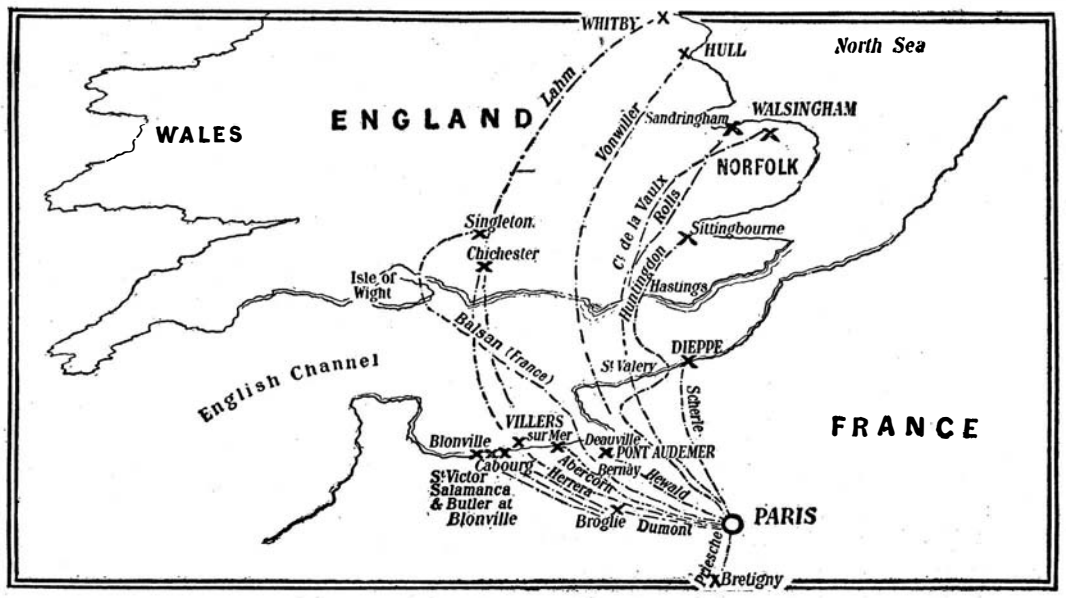
The Inflated Rubber Dummy Which Was Sent Up to Indicate the Direction of the Wind.



Some of the Balloons Which Took Part in the Great Race for the Gordon Bennett Cup.

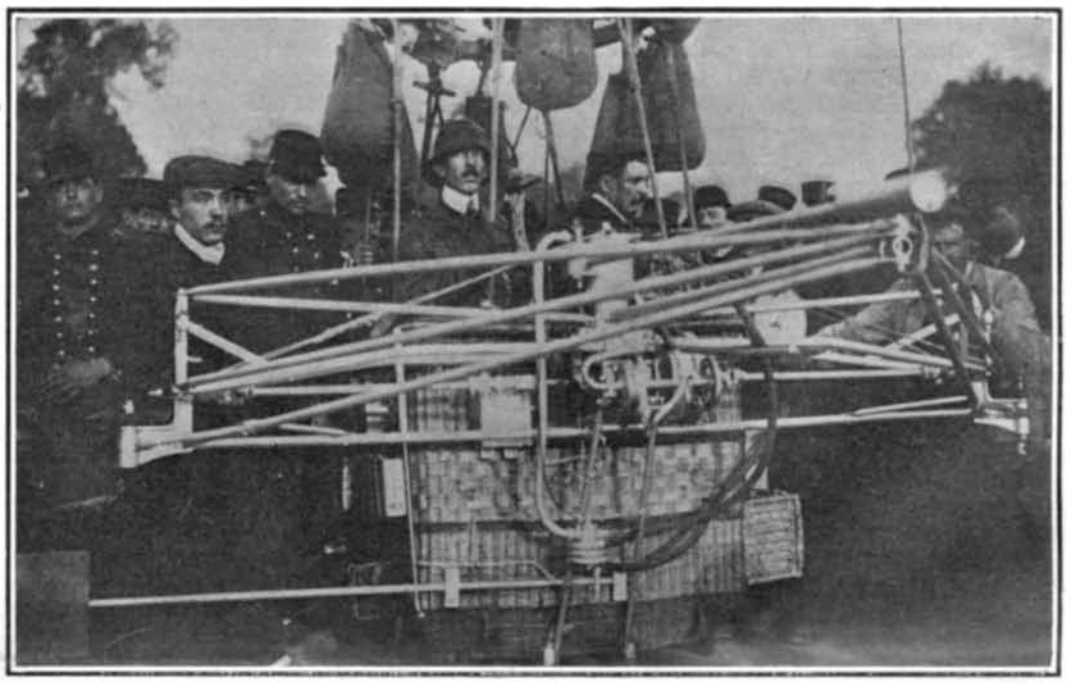
FIRST INTERNATIONAL BALLOON RACE.—WON BY AMERICANS.

spherical type, and had the usual form of rigging and basket, as will be noticed in the different illustrations. The total cubical contents of the sixteen balloons is near 47,000 cubic feet, and the value of the gas used in inflating them is estimated at $1,400, while the total value of the material engaged in the race is $16,000. The largest balloon contains 3,000 cubic yards, and the smallest 1,950 cubic yards. There are twelve balloons of varnished cotton, two of rubber-covered cotton and two of varnished silk. Eleven of them are entirely new and were built specially for the event. Santos Dumont made a sensation at the starting grounds with his new spherical balloon. Faithful to his principles, he adapted a motor and propeller to the basket, which thus presented an unusual form. Fastened to one side of the basket is a framework of aluminium tubes, holding a propeller at either end, while the motor is placed near the middle of the frame against the basket. A shaft running from the motor on each side drives the propellers, and the latter are placed this time in a horizontal position. The propellers are not intended to raise the balloon, but on the contrary, to lower it and keep it near the ground if need be, or else to afford a better control of the balloon's height than can be given by ballast. The motor is to be set in motion only when the aeronaut wishes to descend. A thorough test of this contrivance must still be made before its merits can be judged. Santos Dumont found this arrangement to work reasonably well on the trip, but unfortunately he had an accident before reaching the Channel coast, as his arm caught in the gearing. He escaped with a few bruises, but found that he was unable to go farther and so was obliged to land. His balloon, entered for the Aero Club of America, held about 2,800 cubic yards, being one of the largest. Built of varnished cotton, it weighs 1,600 pounds exclusive of liquids. The propellers, measuring 5 feet in diameter, are run by a 6-horse-power De Dion motor, and run in opposite directions. Lieut. Frank P. Lahm, who carried off the honors and brings the cup to America, was well satisfied with his trip, and crossed the Channel by moonlight, sailing near the surface of the water. He reached the English coast about 3:30 in the morning, passing over Chichester, Nottingham, and Mansfield. The wind grew stronger and near the ground it blew toward the west, while at 3,000 feet height it was in the opposite direction. Thus the balloon reached the coast, and the aeronauts were obliged to descend, not wishing to make the trip over the North Sea. After alighting at Flyinghall, near Robin Hood's Bay, the balloon and the party returned to Paris.

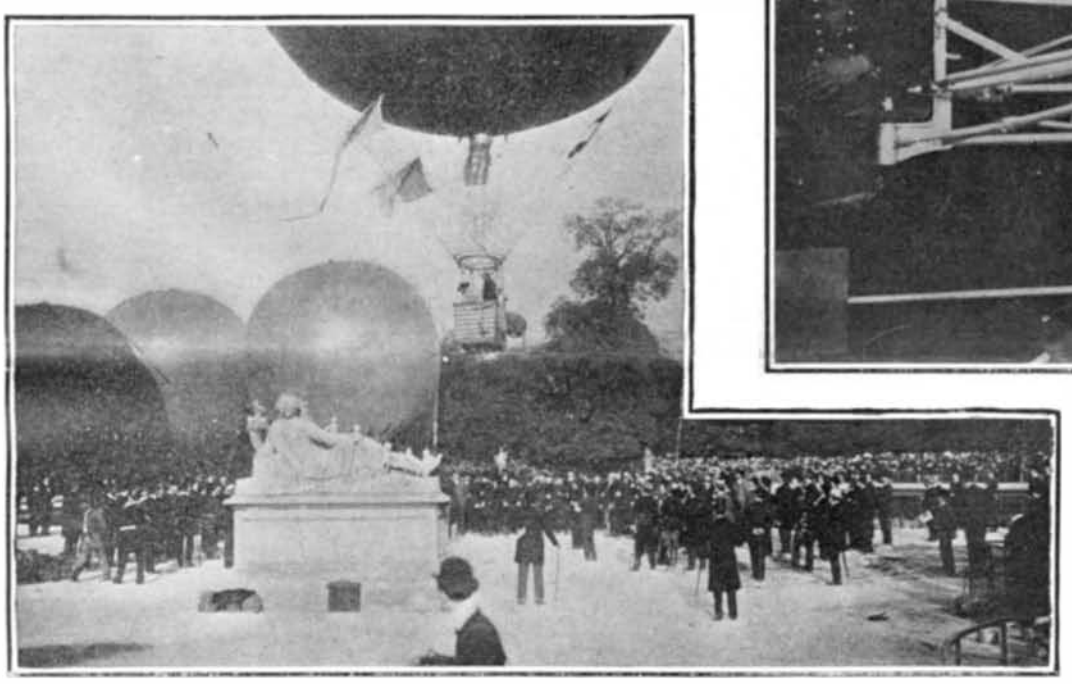



The greatest distance covered was that by the American Lahm (395 miles).

**Gordon Bennett Balloon Race. Map Showing Where the Competitors Landed.**

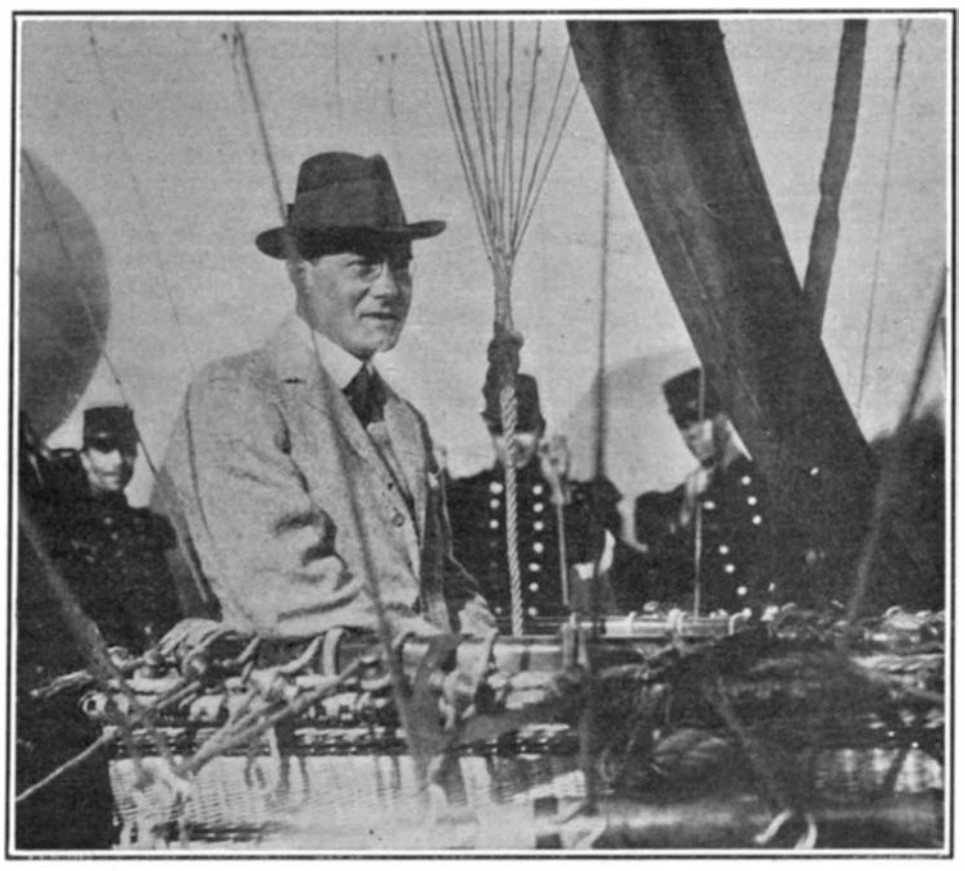


**Santos Dumont in His Car. His Was the Only Balloon Provided With a Motor and With Propellers.**



**The Great Crowd That Watched the Ascension of the Balloons. In This Picture Von Willer Has Just Started.**

**Lieutenant Lahm (the Winner) and His Companion Major Hersey Just Before the Start.**



**Von Willer of the Italian Team Standing in His Car. He Covered a Distance of 360 Miles and Was Second in the Race.**

**FIRST INTERNATIONAL BALLOON RACE.—WON BY AMERICANS.**

# Correspondence.

### Remarkable Change in Holly Wood.

To the Editor of the Scientific American:

Recently I discarded a few scraps of one-quarter-inch thick holly wood, throwing them on the ground floor of a shed. A few weeks later these pieces again came under my notice. I found them colored a beautiful light greenish blue, through and through, and emitting a damp stable-like odor. A few weeks' exposure to sun and rain apparently effected no change in the wood other than removing the odor. Will some of your readers explain this to me through the columns of the Scientific American. C. B. Fowler.

Anacostia, D. C.

### Uniformity of Fleet Individuals.

To the Editor of the Scientific American:

Happening to have read a letter from Mr. Lehmann in a recent number of the Scientific American, I would like to offer a few slight improvements, or what I think would be such, upon his suggestions.

First of all, I must say that I have always felt, as he does, that it was ridiculous to place the two "Maines," of 18 knots, in the same squadron as the two "Kentuckys," of only 16½ knots; or the two "Alabamas," of 17 knots, with the "Indiana," of 15½.

It seems to me, however, that Mr. Lehmann, in his proposed rearrangement, has overlooked the following facts: 1. Three of the later "Connecticuts," which he includes in it, will not be commissioned until the beginning of 1908, about. 2. The "Texas" has been put out of commission permanently. 3. According to his proposition seven ships would have to go about 11,000 knots, in addition to voyages already ordered.

Besides these points he advocates four squadrons containing eight, five, four, and six ships, respectively, whereas it is to be preferred that all squadrons should be of the same size; at least, all in the same fleet. Mr. Lehmann, I may add, has slightly underrated the speed of the "Iowa," "Oregon," two "Kentuckys," and one or two of the other ships.

For all these reasons, then, I propose the following arrangement:

North Atlantic Station.

First battleship squadron: Three "Maines," two "Connecticuts." Speed, 18 knots.

Second battleship squadron: Five "Virginias." Speed, 19-19½ knots.

Third battleship squadron: Two "Alabamas," two "Kentuckys," one "Iowa." Speed, 16¾ knots.

First cruiser squadron: Two "Tennessees," one "St. Louis," two "Columbias." Speed, 22-23 knots.

Asiatic Station.

Second cruiser squadron: Four "West Virginias." Speed, 22¼ knots.

Third cruiser squadron: Two "West Virginias," two "St. Louis." Speed, 22¼ knots.

Fourth cruiser squadron: Two "Albanys," two "Raleighs." Speed, 19-20½ knots.

Pacific Coast Station.

Fourth battleship squadron: One "Alabama," three "Oregons." Speed, 15½ knots.

(And perhaps) Fifth cruiser squadron: Four "Chattanoogas." Speed, 16½ knots.

It will be observed that each of the squadrons in the Atlantic would contain five ships, and each of those in the Pacific would contain four ships, in this arrangement; also that it would only be necessary to transfer three large ships from one seaboard to the other, as against seven, according to Mr. Lehmann's proposition.

In conclusion, I thoroughly agree with him that such an arrangement into squadrons homogeneous in speed, would greatly increase the efficiency of our battle fleets.

This was, moreover, proved by the performance of the five "King Edwards," in the recent British maneuvers. Alfred Jaros, Jr.

Watermill, L. I.

A recent dispatch from France announces the death on September 5 of Albert Tissandier. Tissandier, accompanied by his brother Gaston, who was still more widely known as a navigator of the air, gained great fame by making a successful flight from Paris on October 14, 1870, during the siege by the Prussians. The brothers made several unsuccessful attempts to re-enter the beleaguered city by means of a balloon. Albert Tissandier was born at Anglure, Department of the Marne, in 1839, and some twenty-five years later began his active career as an architect. He was later sub-inspector of works of the city of Paris, and was afterward attached to the staff of the Opera. After the Franco-Prussian war the two brothers devoted much time to the study of aerial navigation, and made a number of ascensions, during one of which they ascended to the height of nearly 8,000 yards. Gaston, who was not only widely known as an aeronaut, but as a distinguished chemist and well-known writer on scientific subjects, died September 8, 1899.

### Magelssen Synthetic Clay.—The Rediscovery of a Lost Plastic Material and Modeling Method.

Throughout Greece and Italy may be found large collections of terra cotta figures of ancient divinities and mythological heroes, most of which are fashioned with remarkable skill, and many of which reach an artistic perfection that seems well-nigh unattainable by modelers of our own day. Tanagra figurines we call them, for the reason that those first brought to public notice, as well as some of the most beautiful examples since found, came from the cemetery of Tanagra in Bœotia.

How these figurines were made has puzzled every sculptor that has ever examined them. That they were baked during some stage of the process of their making seemed certain. Beyond that nothing was known. Attempts to secure the same effects in modern clay have proven dismal failures. The use of the material was not confined to small figures. Indeed, statues of considerable size were often fashioned in this ancient clay. Thus the colossal group at Monte Cavallo in Rome was probably first modeled in clay, dried, and then copied in bronze or marble.

One characteristic is common to ancient clay or terra cotta statuettes and large works in clay. Without exception they are provided with one or more orifices. In the Tanagra figurines the orifice is usually very large and square and is located in the back. It has commonly been regarded as a means of suspending the model from a hook. The presence of the opening in larger works, hardly intended for exhibition in that fashion, has never been satisfactorily explained. It has been suggested with more reason that the openings were provided for the escape of vapor.

Every modern sculptor and every modern physicist knows the impossibility of securing a satisfactory bond between clay and wood or iron. In drying or baking the object the iron invariably expands, and clay, as its water evaporates, shrinks, with the result that it cracks on its iron support and eventually crumbles away. That some support must have been used in ancient terra-cotta figures of more pretentious dimensions, mechanical considerations would alone presuppose; that they dried or that they were baked without cracking is a startling inconsistency in the light of modern experience.

A Norwegian sculptor, Christen Daa Magelssen, after a study of these ancient masterpieces extending over a period of more than thirty years, a study which has involved countless experiments with various plastic materials, has discovered the secret of the ancient modeler's success. Contrary to current archeological supposition, that success was not due to superior craftsmanship, but to the choice of a material which would lend itself to the utmost freedom of treatment, which gave no unpleasant reflections, due to the presence of unneutralized alumina, and which could be dried or fired without cracking and without dropping from its support. The composition of that material, or at least a material resembling it in its attributes, Mr. Magelssen has discovered.

A long, painstaking study of Greek tanagras convinced Mr. Magelssen that the figures had been built over an inflammable core, and then fired, with the result that the core was burned out, leaving the figure intact. Because such a feat was impossible with modern clay, impossible because the clay would crack on the core, he was convinced that the ancient modelers used a clay differing in physical properties from that with which modern sculptors are familiar.

Broadly stated, Mr. Magelssen has invented a synthetic clay. He crushes to a powder any natural rock, such as granite and gneiss, rich in silicates and alumina, in short, a rock resembling clay in chemical composition as closely as possible, and to this powdered rock he adds sulphuric acid and iron sulphate in quantities varying with the chemical composition of the particular rock employed. No organic matter of any kind is added, wherein this synthetic clay differs most from the clay of nature. Clay is the only substance which when fired is preserved in permanent form. The impurities, such as organic matter, are the cause of the clay's cracking over iron or wood.

Magelssen clay has been examined and approvingly commented upon by the foremast archeologists and sculptors of Europe—among them such noted authorities as Mr. Cecil Smith, of the British Museum; G. Körte, of the Imperial German Archeological Institute of Rome; Vilhelm Bissen, the Danish sculptor; Luigi Guiglielmi, an Italian sculptor who fills a professorial chair at the Accademia di San Lucca; and Mr. Franklin Simmons, a well-known American sculptor residing in Rome.

The chief characteristics of Magelssen clay are its remarkable plasticity and its ability to withstand intense heat without shrinking or cracking. Small heads and figures made from this synthetic clay bear so striking a resemblance to antique Tanagra figurines that Mr. Magelssen's theory of the process which was probably employed by the ancient modeler seems most plausible. The objects are built over a core of wood shavings or the like, which core is burned out. An orifice is naturally provided for the escape of the gas and smoke, in order to avoid distortions which might be produced by the internal pressure of the vapors. This explains the significance of the large opening which is invariably found in Tanagra figurines, and which, as we have stated, was long thought to have served as a means of suspending the object from a nail, despite the circumstance that the opening was sometimes most unhappily located for such a purpose. Iron rods may be used as supports for larger works, and the clay will adhere to them without the slightest danger of destroying the bond between the two diametrically opposed materials during firing and subsequent cooling. Casting in plaster is unnecessary. It is, therefore, possible to model groups of colossal size, to bake them together with the iron skeletons by which they are upheld, and to point them out in marble from the dried clay. Mr. Franklin Simmons gives it as his opinion that Magelssen clay "is beautiful to work in, as the artist is able to finish his work more rapidly than in the common clay; also to see the forms more clearly, thus being surer of what he does." To the same plasticity, and above all, to the felicitous light effects, Mr. Magelssen attributes the wonderful technique of the ancient sculptor. Mr. Magelssen has lectured with success in Rome on his process and hopes shortly to deliver a public address in New York.

Industrially the invention is of vast importance, inasmuch as it is now possible to shape clay into coils, thin bent pipes, and thin and light vessels of any size.

### Floating Oysters.

Some time ago an oyster-breeder in Morbihan, named Martine, called the attention of the Académie des Sciences to the appearance of unknown algæ that threatened to ruin the oyster-beds established at the mouth of the river Vannes. These algæ (which the breeders called *ballons*—balloons) assume the form of little brownish-green leather bottles or wine-skins, which stick to the oysters, and which, microscopic at the start, very soon reach the size of a large hen's egg. Formed of a very thin, elastic and rather frail coat, these bottles, usually full of water, fall in upon themselves at the moment of low tide. They become empty then by the rents in their exterior; but, in virtue of their elasticity, they fill up again with air. At the return of the tide, they thus form a float more than sufficient to raise up the oyster that serves them as support. Therefore at each great tide, when the beds are wholly uncovered, the oysters are seen to disappear in the offing upon this automobile alga.

According to M. Bornet, we here have to do with the *Colpomenia sinuosa*, very frequent in all warm seas, abounding notably in the Mediterranean and in the tracts adjacent to the Atlantic. It was pointed out for the first time at Cadiz at the beginning of the last century, and has never been seen farther north. It no doubt came upon the hull of a vessel, and, having found in the gulf of Morbihan a suitable water, it multiplied there. Hitherto no other effective means has been found of combating this alga, than to sweep the beds with prickly fagots. It is to be hoped that a rigorous winter will be sufficient to cause it to disappear.

### The Current Supplement.

Dr. Alfred Gradenwitz describes the Boffalora-Ticino power plant in the opening article of the current Supplement, No. 1608. Excellent illustrations accompany his text. The second installment of the digest of regulations and instructions concerning the denaturation of alcohol is published. Mr. Henry Hess writes most instructively on ball and roller bearings. To the naval reader the article on the minor navies of the world will be found of interest. A very good review is presented of the fixation of atmospheric nitrogen as it was discussed at the German Bunsen Society. Those who are under the impression that the present popularity of reinforced concrete is a fad will have that impression removed by the excellent article on the progress and logical design of reinforced concrete. The splendid treatise on mercury vapor apparatus by Percy H. Thomas is concluded. Prof. A. E. Outerbridge presents a very good summary of recent progress in metallurgy. The Parisian Museum of Accident Prevention is described and illustrated. The accidents which are prevented are those caused by factory machinery.

The Frahm apparatus for frequency or speed measurement by means of resonance—either mechanically or electrically set up—with one or more of a series of vibrating tongues of known periodicity has now been in use for over two years, and has proved very satisfactory. Numerous attempts to make it a self-recording instrument have, however, failed, chiefly owing to the friction between the recording pen and the paper. This difficulty, says the Electrical Engineer, has been overcome by making the record photographically.

### An Electrical Method of Testing Mineral Waters.

Mineral waters can be tested easily by the new electric method which consists in finding the electrical resistance of the water. D. Negreano, of Paris, shows that this resistance is almost always a physical constant and has a given value for each kind of water, thus showing the difference between it and other mineral waters. This method may prove to be a valuable one in practice. The following are some of the values which he found for some of the leading mineral springs of the Continent, giving the values in ohms per cubic centimeter at 18 deg. C. Caciulata spring, Roumania, 328; Slavic No. 1, 114; No. 3, 48; No. 6, 27.5; Vichy Celestins, France, 140; Vittel, Grand Source, 500; Evian, Cachet, 1,280. Other tests showed that the resistance diminished with the temperature, and provided the interval is not too large, the resistivity $R_t$ at a given temperature, compared with the resistivity $R$ at the standard of 18 deg. C. can be expressed according to the following equation $R_t = R\ [1 - a\ (t-18)]$, in which $a$ is a coefficient of temperature variation which is found for each specimen. Generally $a$ is near 0.02. For the above series of mineral waters, the values of $a$ are as follows: 0.019; 0.24; 0.023; 0.024; 0.023; 0.027; 0.026. The important point about the above researches lies in the fact that the resistivity of natural mineral waters seems to be constant at a given temperature and it is also different from the value of artificial or imitation mineral waters stated to be obtained from the same springs. As an example, Vichy Celestins water showed 140 ohms per cubic centimeter at 18 deg. C., while artificial Vichy water showed 112 ohms. With Evian water the results were 1,280 and 1,120 ohms respectively. These results show that the method can be easily applied in detecting mineral waters and guarding against imitation.

### Origin of the Pearl.

The origin of the pearl in the shell of the oyster, or other bivalve or mollusk, has been the object of a considerable amount of investigation and speculation. Among the more recent studies of the subject may be noted those of M. Seurat, recorded in the Comptes Rendus. This naturalist finds that in pearl oysters from the Gambia lagoons, in the South Pacific, the pearls are due to a small worm—a sort of tapeworm. In cysts on the body and mantle of the oyster he has found true pearls surrounding a nucleus which he has shown to be one of these worms. Like other tapeworms, this one, concerned in the production of pearls, requires a second host in which to complete its development. And M. Seurat considers that the ray is the second host in this case, for he has found in the spiral intestine of this fish small tapeworms, which he regards as the adult form of the larval worm of the pearl oyster. The author has named this new species of tapeworm *Tylocephalum margaritiferae*. The view has been held that the pearl is a secretion formed, as it were, in self-defense for the surrounding and isolation of an injurious foreign body.

### Suggestions for the Deaf.

In the apartment of Mrs. Anna M. Town, of Utica, N. Y., is an arrangement of electrical lights that is of practical service to those who cannot hear the ringing of the door bell and telephone bell. When the telephone bell rings in the rear of the apartment, a brilliant light flashes up in the front room and remains lighted until turned off.

This light is so arranged that it flashes into the looking-glasses of three rooms. A light can be placed in every room if desired. The electric door bell is arranged in a similar way, the light being of another color. The arrangement has been in use two years, proving satisfactory and inexpensive. Most deaf people can hear over a telephone. By adopting this plan a telephone is quite as useful to a deaf person as to one who can hear. In case of illness, when the ringing of bells is to be avoided, this arrangement seems an admirable one. When the lights are used, the bell is also retained. A movable bulb that can be taken to any part of the house is a great convenience. The door bell in that case is silent.

### Marconi Stations in Canada.

The Canadian government is still further extending the organization of the Marconi stations, which they have established for communication with ships, and from point to point along the coast. When two new stations at Father Point and Seven Islands are completed, there will be a continuous Marconi system from Quebec right up to Labrador on the one side, and to Cape Race on the other.

According to the Engineering and Mining Journal manganese bronze has practically driven aluminium bronze out of the market, or to such an extent that the disparity in the quantities used is very great. This condition has taken place not because of the superiority of manganese bronze over aluminium bronze, but because it is cheaper—containing nearly half zinc—and may be more easily cast.

### THE BATTLESHIPS "DREADNOUGHT" AND "SOUTH CAROLINA."

Popular interest in naval affairs varies greatly with the events of the hour. Just now it is particularly keen, having been stimulated by the recent and very successful trials of the battleship "Dreadnought"—the first battleship designed and built since the Japanese war to embody the lessons of that famous struggle. Moreover, a few weeks prior to these trials, the contracts were let for the construction of two United States battleships, the "South Carolina" and the "Michigan," which also have been planned to meet the modern conditions of naval warfare as exemplified in the same war. On the following page, these two types are shown in a spirited picture, which affords an excellent opportunity of comparing their likenesses and very marked differences. The "Dreadnought" was completed in September of the present year, and the "South Carolina" and "Michigan" are to be completed in the spring of 1910.

By the courtesy of the Japanese government the British Admiralty was allowed to have a representative on several of the Japanese warships during the whole series of operations. They were present on the battleships that fought on August 10 to repel the great sortie at Port Arthur, and they were also present in the conclusive battle of the Sea of Japan. They brought home with them a large amount of valuable data, which was placed at the disposal of the Chief Naval Constructor, Sir Philip Watts; and it was this information that determined the salient features of the "Dreadnought." The novel characteristics of the ship, then, are based upon the following lessons of the war:

First, the enormous superiority of the 12-inch gun when used at the long ranges at which future battles are likely to be fought.

Second, the advisability of mounting the battery so as to obtain a maximum concentration of fire in every direction.

Third, the guns must be so positioned with regard to each other that the blast of one gun shall never inconvenience the crew of any other gun.

Fourth, the advantage of mounting all guns behind heavy armor, and, if possible, within turrets.

Fifth, the advisability of as wide a separation as possible of the gun positions, so as to limit the destructive effects of a well-placed shell.

Sixth, the necessity of reducing to a minimum all top hamper, such as masts, boat cranes, stays and shrouds, and superstructures built of light shell plating, which serve merely to intercept and burst high-explosive shells.

Seventh, the marked advantage of large displacement in affording lofty gun platforms and superior stability in a seaway.

Eighth, the undisputed advantages, both strategical and tactical, of high speed and generous coal supply.

Lastly, and perhaps most important of all, the necessity of providing several armored positions (conning towers), from any one of which the fighting of the ship may be carried on.

Let us now see in what way provision has been made in the "Dreadnought" to meet these requirements.

First, the armament consists of ten 12-inch, 45-caliber guns of a new pattern, with the unprecedented service velocity of 2,900 feet per second, capable of penetrating 22 inches of armor at 3,000 yards and 17½ inches at 5,000 yards.

Second, by mounting three of the turrets on the center line of the vessel and one on each broadside, and cutting down the forecastle deck to the level of the main deck in the line of dead-ahead fire of each of the turrets on the broadside (the decks and bulkheads being specially strengthened to resist the blast), the "Dreadnought" can concentrate six 12-inch guns dead ahead or dead astern and eight 12-inch guns on each broadside.

Third, the turrets have been so situated with regard to each other, that in no position in which the guns can be brought to bear will their blast inconvenience the gun detachment in any of the other turrets. When the guns of the two turrets on the beam are firing dead ahead, the detachment in the forward gun turret on the forecastle deck will be well up above the line of blast. When these guns are firing astern, the two after turrets on the main deck will be too far removed to be seriously affected.

Fourth, all the 12-inch battery is mounted within revolving turrets protected by 11 inches of sloping Krupp armor, equivalent in its resisting qualities to at least 15 inches of vertical armor. Throughout all the engagements of the Japanese war the gun detachments that were housed within the heavy turrets were practically immune from the effects of shell fire.

Fifth, the principle of wide separation, which has proved to be so advantageous in land operations as, for instance, in the advance of an attacking body of infantry, is of equal importance as a defensive element in the placing of the guns and their gunners on a warship. The principle has been admirably worked out on the "Dreadnought," where the 12-inch turrets, as viewed from the broadside, are separated by fully 100 feet of distance from center to center of turrets. The chances of a single shot doing injury to two turrets is very remote. Similarly, shots aimed at the ship as a whole must be limited in their destructive effect to a single turret, its guns, and its gunners.

Sixth, the masting of the "Dreadnought" is self-supporting, that is to say, it does not depend upon shrouds and stays to be held in place; and it is of enormous strength. Each mast consists of a tripod made up of three steel tubular legs of great stiffness, and this tripod arrangement renders it impossible for a single high-explosive shell to bring the mast down. One of the legs might, indeed, be entirely shot through, and the structure yet retain sufficient strength to stand erect. Moreover, stays and shrouds, which are particularly vulnerable to high-explosive shells, are done away with, even the smokestacks being unstayed and self-supporting; and, except for a short superstructure at the after end of the forecastle deck, the ship is free from light deck houses and structures which, as the Japanese war showed, merely served to intercept and burst the shells.

Seventh, the large displacement of 18,000 tons and the broad beam of 82 feet enable the "Dreadnought" to carry her guns at a great elevation, the axis of the forward pair being 34 feet above the water line, and the axis of the other guns from 26 to 28 feet above the sea level. Moreover, her great size conduces to slow movement and long easy roll in a seaway—most important considerations for the gun pointer.

Eighth, on the high seas just as much as upon land, mobility is of prime importance; for mobility means the power not only of concentrating in force and quickly at some desired point in the enemy's country, or upon the high seas, but it also means the ability to make a rapid change of formation while the tactics of the actual fight are being developed. In this respect the "Dreadnought," which has recently shown a sea speed of 21½ knots an hour on a continuous run of 172 knots, is most favorably placed. She is driven by quadruple turbine engines; and the fact that her coal consumption is probably about 1.5 pounds per horse-power hour, coupled with her large coal capacity of 2,700 tons, will give her an unusually wide radius of action at cruising speeds.

Lastly, at least one great naval battle of the Japanese war, the sortie of August 10, was lost by the Russians at a time when matters were going pretty evenly between the contestants, because at a critical moment the conning tower and bridge were wrecked by a single 12-inch shell, the admiral killed, and the ship left without a controlling hand. The "Dreadnought" is provided with three separate conning towers, each provided with a complete set of telephones, telegraphs, etc., from each of which it will be possible to fight the ship. One of these is immediately below the navigating bridge at an elevation of about 45 feet above the water line; the other is just forward of the aftermost smokestack, and the third is located between the two after turrets.

Altogether, it must surely be admitted that, considering how soon after the war the plans of the "Dreadnought" were decided upon, Sir Philip Watts has turned out an exceedingly powerful and effective ship.

Our own battleships, the "South Carolina" and "Michigan," are equally creditable designs. When we consider that they are of 2,000 tons less displacement than the "Dreadnought," it must be admitted that in offensive quality, at least, they are, in proportion to their tonnage, fully the equal of the British vessel. On the other hand, the "Dreadnought" is already in commission, having successfully completed her speed and gunnery trials; whereas it will be over three years before the "South Carolina" goes into commission. The armor on our ships is slightly heavier, and, being smaller vessels and shorter, they present smaller targets, and therefore are less liable to be hit; although this is somewhat offset by the fact that the bigger ship takes longer to sink, and can stand a proportionately larger amount of hammering. Taking the military features of the "South Carolina" seriatim, as in the "Dreadnought," we find that:

First, she carries eight 12-inch, 45-caliber guns, having a service velocity with nitro-cellulose powder of 2,700 feet per second, and that her shells are capable of penetrating 19 inches of armor at 3,000 yards, and 15 inches at 2,000 yards.

Second, by mounting one of each pair of turrets, forward and aft, some 8 feet higher than the adjoining turret, a maximum arc of training is obtained for all of the guns, four guns firing dead ahead and dead astern and eight on either broadside.

Third, the above system of mounting serves also to obviate all difficulties from blast interference; for our naval designers are satisfied that, even when one pair of guns is fired directly across the roof of an adjoining turret, there will be no serious inconvenience caused to the gun crews. The excellent character of

the port shields which are mounted on the chase of the guns, and the new method of constructing and locating the sighting slits, is depended upon to prevent the entrance of the blast into the turrets.

Fourth, all of the main battery is mounted within elliptical turrets protected by 12 inches of inclined armor.

Fifth, the one serious criticism which can be made against these ships is due to the bunching of the turrets and their guns in two positions with the two conning towers closely adjacent. Each of these positions offers a very tempting mark to a gunner who has once got the range to a nicety. This is a feature, however, which was doubtless thrust upon our designers by the limited displacement allotted by Congress for these ships, and it is a defect which will doubtless be corrected in our next and larger battleships.

Sixth, to the same controlling element of limited displacement is to be attributed the crowding of the masts, boat cranes, and smokestacks into a limited position amidships. High-explosive shells would be liable to produce pretty bad wreckage on this portion of the ship. However, the main battery is sufficiently far removed forward and aft to escape any danger of the turrets being jammed by falling debris of masts or smokestacks.

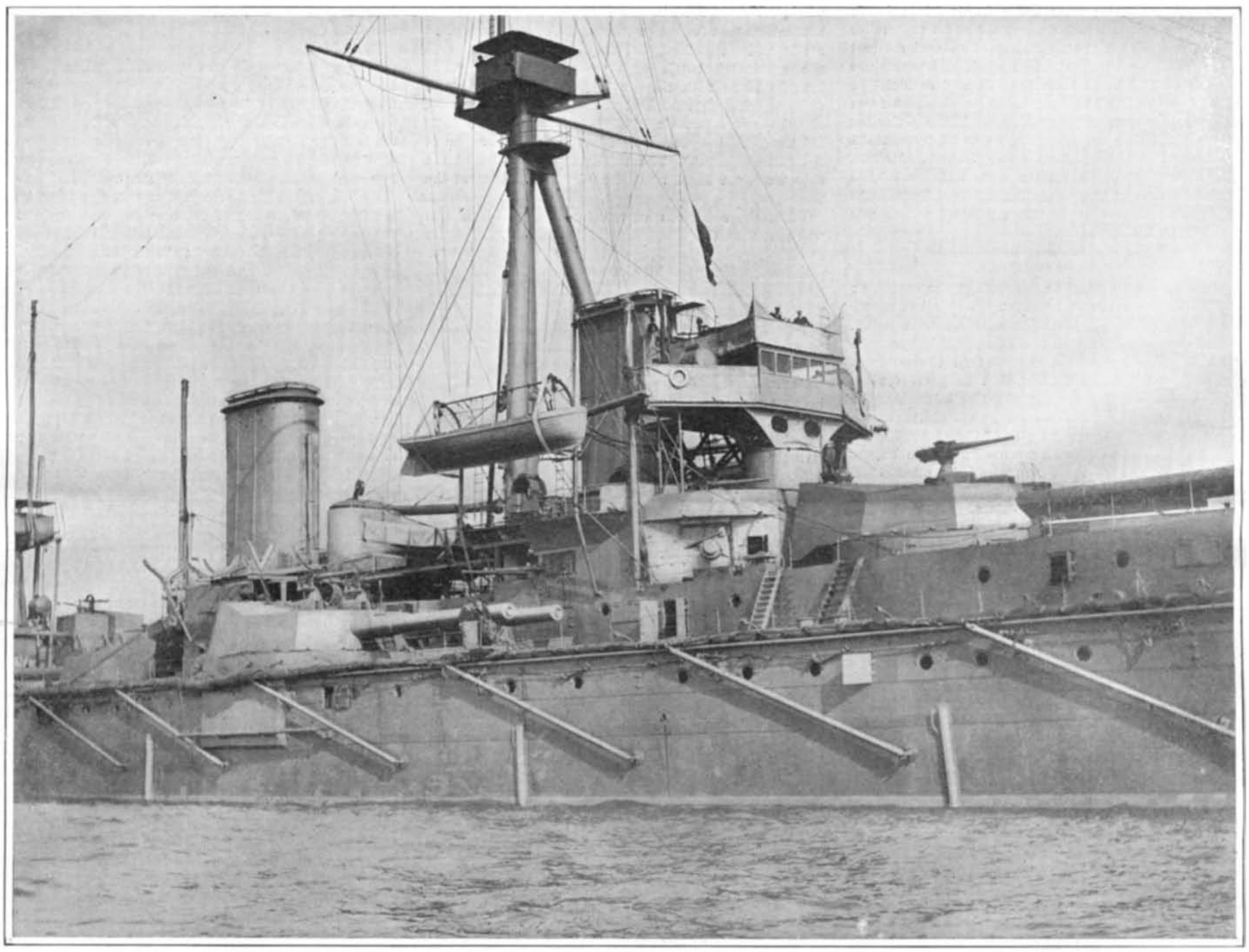
Seventh, the gun command, forward, is excellent, the foremost pair of guns being fully 24 and the adjacent pair 32 feet above the sea level. The smaller size of the "South Carolina" necessitated cutting down the quarter deck, so that the aftermost pairs of guns are respectively 8 feet lower than the corresponding forward guns.

Eighth, the proposed speed of the "South Carolina" is 18½ knots, and she has a maximum coal supply of 2,200 tons, both of which features, having in view the excellent offensive and defensive qualities of the ship, are all that could be reasonably expected in a 16,000-ton vessel.

Lastly, the "South Carolina" and "Michigan" are provided, each of them, with two separate conning towers, one at the forward and one at the after end of the superstructure.

As regards the future, there can be no doubt that the big battleship has come to stay, and that she will be a vessel of high speed. Further indication of this is seen in the three new, so-called armored cruisers "Invincible," "Inflexible," and "Indomitable," of the British navy, which are to carry the same number of 12-inch guns and to have the same all-round concentration of fire as the "South Carolina" and "Michigan," but are to be of over 17,000 tons displacement and are to have a speed of 25 knots an hour.

Our future battleships will undoubtedly be true to the traditions of our navy in mounting an exceedingly powerful battery; but we believe that this tradition should not be carried to the extent of preventing their speed being brought up considerably nearer to the 21½-knot mark, as now set by the "Dreadnought." The value of speed was established beyond all question by the events of the Japanese war.



**View Showing Forward and Starboard 12-Inch Gun Turrets, Forward Conning Tower, Bridge, Tripod Mast, and the Midship Conning Tower Forward of the After Smokestack. The Ship Was Built in Eighteen Months.**

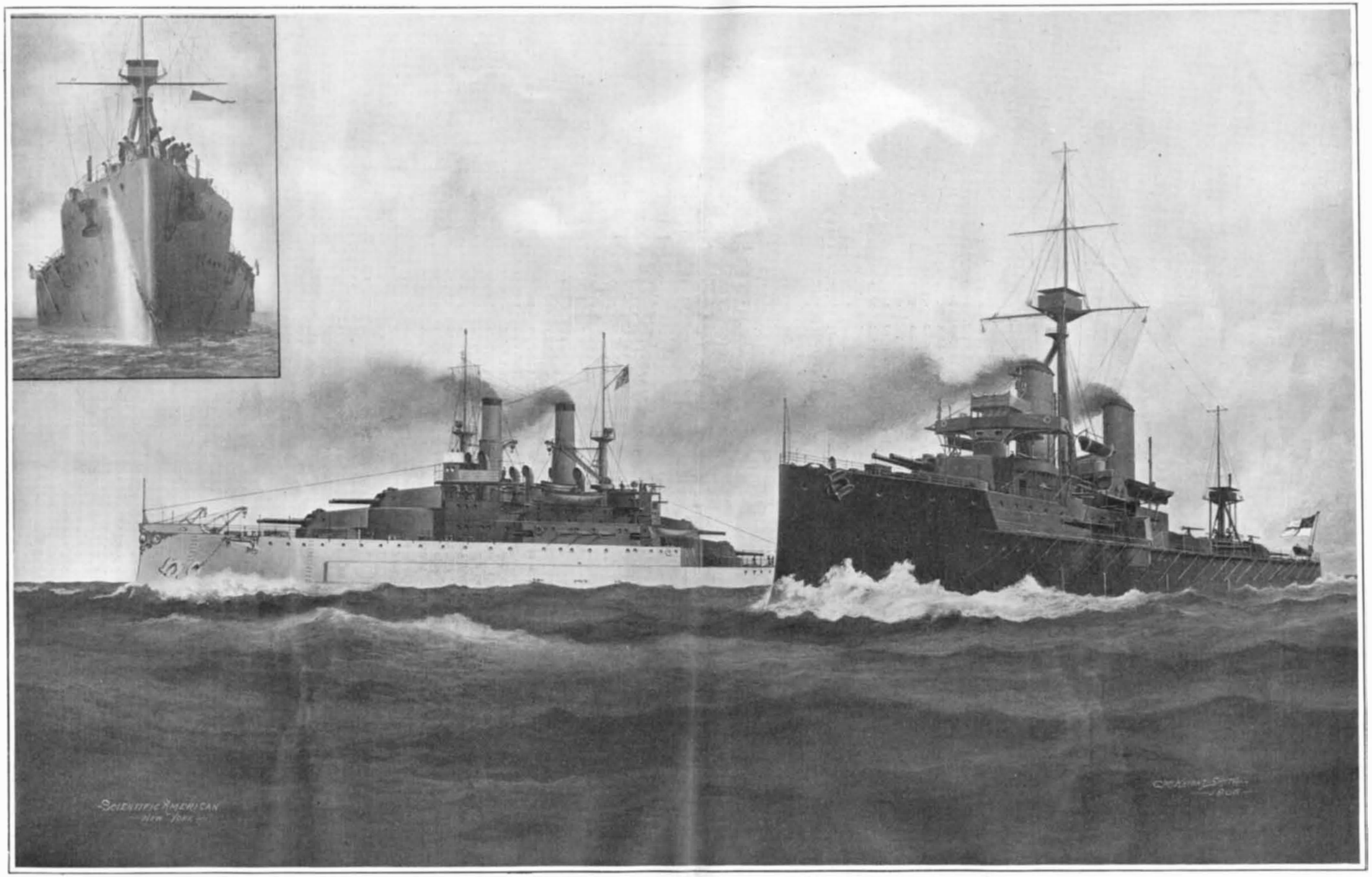
**THE "DREADNOUGHT" LEAVING PORTSMOUTH FOR HER TRIAL TRIP.**

### A New Process of Color Photography.

A new process for color photography has been brought out by Prof. Lippmann. In order to reproduce the colors of the object we must first have the sensitive plate keeping the trace of the differences which are found in the radiations coming from the same incident beam, thus analyzing the beam, and second, the incident light must afterward give the corresponding color effect. He proposes to use the principle of the prism, and this may give the desired solution. A photographic spectroscope is composed of a slit, prism, lens, and sensitive plate, and the light which falls on the plate is here separated into its component parts. It remains to show that the apparatus is reversible and that we can re-form the light which entered the slit. Suppose the plate to be developed and then put back in place. If red light had fallen on the slit, there would be a red image of the slit on the screen. Making a positive plate of the image we form as it were a second slit which corresponds to the first slit. We must now make the action reversible, and such is the case, for when we light the positive plate by white light, we have only the red light at the other end. Thus the red light of the first instance corresponds to the red of the second case. The same applies to other colors. When the positive plate is exposed to white light, the slit receives a light which has the same composition as what was given during the first exposure. When the positive plate is replaced by the negative, all the other colors now pass, and we receive the complementary color at the other end. Here the place which the color has in the spectrum is shown by an opaque line, and such a ray could not now fall on the slit. To resume, when the positive plate is put in place in the spectroscope, it only lets pass the light which fell during the first exposure of the plate. With the negative plate, we have the complementary.

To apply this principle to color photography, M. Lippmann devised the following apparatus. The slit is replaced by a closely-spaced set of narrow slits, the whole resembling a set of fine lines, ruled to 125 per inch. This screen is fixed at the opening of a photographic enlarging apparatus, carrying at the other end a plate-holder, while in the center is a converging lens. In front of the lens is a small-angle prism with its edge parallel to the lines of the screen. The image to be reproduced is thrown on the screen. Then the plate is developed and the negative (or positive) put back in place. With the positive plate, when the latter receives white light at the back, we have the original image, with its natural colors, seen on the screen. Each line of the ruled screen acts like a spectroscope slit, and at a distance the eye does not see the separation, so that the image seems continuous. In the experiment, a spectrum was thus reproduced by means of the positive plate. A red and green glass screen was placed over the ruled screen, and it was reproduced again, and also with its complementary colors. The prism must have a small enough angle so that each spectrum has a smaller length than one space between the lines of the screen. As to the negative or positive plate, it appears like a series of white and black lines, but when examined by a glass we see the zones between the lines, corresponding to each small spectrum.

In an article on "Prehistoric Iron," the Industrial World states that during Roman occupation from the middle of the first century to 411, England had a commercial iron industry, which has been continuous to the present time. The Swedish industry has been continuous from the thirteenth century, or earlier. In America the first successful attem[illegible] at iron making was at Lynn, Mass., in 1645.




Bow View of "Dreadnought." Forecastle Deck Cut Away for Forward Fire of Guns on Beam.

| | Year of Completion | Displacement. | Speed. | Coal Supply. | Motive Power. | Maximum Freeboard. | Minimum Freeboard. | Number of Guns. | Fire Ahead. | Fire Astern. | Broadside Fire. | Least Distance Cen. to Cen. of Turrets. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| "South Carolina," | 1910 | 16,000 tons | 18½ Knots. | 2,200 Tons. | 2 Reciprocating Engines. | 22 Feet. | 14 Feet. | Eight 12-inch. | Four 12-inch. | Four 12-inch. | Eight 12-inch. | 35 Feet. |
| "Dreadnought," | 1906 | 18,000 " | 21½ " | 2,700 " | 4 Turbines | 30 " | 22 " | Ten " | Six " | Six " | " " | 100 " |

UNITED STATES "SOUTH CAROLINA" AND BRITISH "DREADNOUGHT"—DESIGNED ON RESULTS OF JAPANESE WAR.

### Tame Trout.

BY CHARLES F. HOLDER.

Among the interesting localities of the Pacific coast the Bay of Monterey is pre-eminent. I believe Dr. Jordan states that here are found more distinct varieties of fishes than in any one locality on the coast.

Certainly this is not confined to fishes, as a few days ago when angling for salmon in their sea run in the bay, I saw a strange assortment of invertebrates, among them the physalia or Portuguese man-of-war, so common in the tropics.

In a recent article I described some tame sea-lions at Santa Catalina. At Santa Cruz, in the St. George Hotel, one of the proprietors is much interested in fish culture, and in the office of the hotel he has a small tank containing perhaps fifty trout ranging in size from five to eight inches in length, some possibly longer. They are rainbows, brook trout, and steelheads, and are absolutely tame. I first noticed that when I went near the tank they crowded to the front and lined up, facing me, eager for something, and I found this to be due to the fact that at this time the owner fed them. He was kind enough to extend this prerogative to me, and handing me some chopped meat, red and inviting, asked me to hold it over the tank.

I have seen the rainbow rise to the lure in its native wilds; seen it leap for the fly; but this was the first time I ever saw one leap at myself. No sooner did my fingers appear over the water than half a dozen fishes surged up, and one big fellow almost cleared the water and seized the meat, while the others fought to take it from my hand. It was a strange and extraordinary spectacle. I had often in wading down a trout stream for this same game, approached a pool or riffle with the greatest care, maneuvering to make the right approach to get the wind behind me so that I could make the longest cast and have my fly literally appear to drop out of a clear sky or come down stream naturally to the fish heading up; but here were the same fishes fighting to nip my fingers, and absolutely as tame as cats. I say cats, as these trout rubbed their sides against my hand, and seemed pleased at the attention I was giving them.

Even more interesting was the exhibition given by the owner. He would indicate certain fishes that were a certain age and say that they were not so tame as others, though I could see but little difference. All were marvelously tame; indeed, the owner had raised them from "fry," and had always handled them. As he placed his hands in the water they crowded about, and appeared to enjoy being lifted up, and the spectacle—to me, at least—of a big trout lying complacently in his hand *out of water* and perfectly at ease and comfortable, was remarkable. I tried the same experiment with a wild trout later, and the performance did not appeal to the trout.

At Brookdale, about five miles above Santa Cruz in the mountains, the county has established a large trout hatchery from which the streams of the neighborhood are stocked. Here one may see trout of all sizes and ages, an attractive spectacle. It was interesting to note how quickly they felt or heard a noise. I happened to be standing by a large tank of big rainbows when the little narrow-gage train came down the mountain. I could hear it a mile or two distant, and the trout noticed it at once, and their fright increased until the train reached the hatchery, when they displayed every evidence of alarm and fear.

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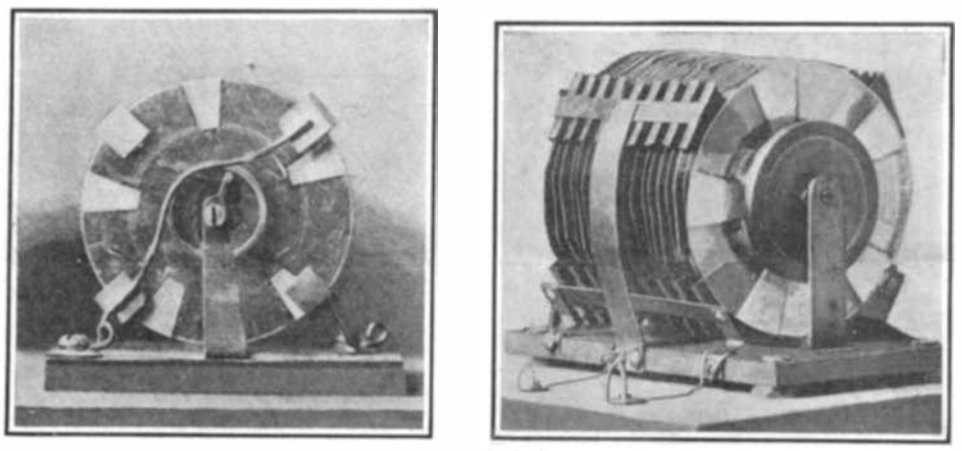
Geodetical observations have shown that the density of the earth's crust is variable, but they have not given any positive indications of the depths to which these observed variations extend. All calculations of the depths of subterranean variations in density and of the mountain compensation have, therefore, to be based on arbitrary assumptions of depth. The fact that the plumb-line seems generally to respond readily to the results given by the pendulum perhaps justifies the inference that the observed variations in the density of the earth's crust are not deep-seated. If an abnormal amount of matter exists in the crust near the surface, it will exercise direct effects upon plumb-lines and pendulums in the vicinity, but if it lies at a great depth its effects, especially on plumb-lines, will be less perceptible. Col. Burrard has taken several instances of abnormal pendulum results from the table, and has found in each case direct response from the plumb-lines at neighboring stations. This conformity could hardly ensue if the variations in density extended to greater depths than thirty or forty miles. Our results do not justify us in asserting that no deep-seated variations in density exist, but they do justify the belief that the variations in density which have been discovered are apparently superficial.

### A MOTOR THAT RUNS BY LIGHTNING.

BY C. FRANCIS JENKINS.

When a glass rod is rubbed with a silk cloth, it acquires the property of attracting light objects. It is electrically charged with a charge of high tension and small quantity. A stick of sealing wax acquires like properties, but on proper investigation it will be noted that the charges are dissimilar. If a pith ball be suspended between the glass rod and the rod of sealing wax it will oscillate, contacting with the rods in turn, taking first a positive charge from the one and exchanging it for a negative charge from the other. The pith ball, after taking up a positive charge, for example, swings away from the rod because it is repelled by the like charge of that rod, and at the same time it is attracted by the unlike charge on the other rod. So the oscillations continue until the charges on the two rods are again in natural equilibrium.

The machine illustrated herewith is based on this phenomenon, and in its simplest form consists of a thin glass or mica disk supported on pivotal points and well balanced. This disk has five armature sections of tinfoil overlapping the edges of the disk at five equidistant points. Enveloping the disk also at equidistant points are four metal field poles, each field pole electrically connected with the field pole diametrically opposite. Each pole has a thin brush mounted thereon, which contacts with the armature sections as they pass thereunder. As there are five armature sections and but four field poles, some one of these brushes is always in contact with an armature section. If, now, one pair of opposite field poles be positively charged and the other pair be negatively charged, some one of the armature sections receives a charge of like sign with the field pole enveloping it. The armature section is, therefore, immediately repelled, and moves away from the field pole and toward the next field pole, to which it is attracted for like reason. As it passes under the brush of the latter field pole the charge is given up for one of unlike sign, and the armature section is in turn repelled by this field pole. Similar phenomena are taking place at each of the other field poles, and continuous rotation at high velocity is maintained.



A MOTOR THAT RUNS BY LIGHTNING.

To increase the torque, a battery of armature plates were mounted on a single shaft, and all the like armature sections in a row (parallel to the shaft) were connected together. Thus a larger capacity in each of the five armature sections was secured. The field poles were likewise connected together. But one set of brushes were required. These brushes were arranged to contact with the armature sections only just after each had passed the median line of each field pole. Therefore the motor always turned in the same direction. Any suitable source of high-tension current sufficed for power, as, for example, an induction machine. A charged glass rod held to one and a charged sealing-wax rod held to the other of the field posts was sufficient to cause considerable rotation of a single-disk motor.

In experiments in wireless telephony a pole supporting wires fifteen feet above the roof of a two-story frame house was used. It was noticed that on the occasion of storms there would be sparking at the gap in a plug cut-out block on the instrument table. It was found that on connecting the motor between the points, that is, so that one field pole was in metallic communication with the earth and the other with the aerial, the motor would run, beginning some little time before the rain began to fall. It was also noticed that the motor did not always behave similarly; sometimes it would revolve rapidly, while upon the occasion of other storms the torque would be weak.

As the force of attraction and repulsion is in proportion to the capacities of the opposed surfaces, it would seem that a motor of considerable power might be constructed to run by static current taken from the passing clouds, and this is suggested as a line of research of not unpromising results.

### Vaccine for Tuberculosis.

Drs. Calmette and Guerin of the Pasteur Institute of Lille have finally discovered a vaccine which will render humanity immune from the dreadful scourge of tuberculosis.

Dr. C. Guerin, with regard to infection from tuberculosis and its remedy, says:

"Many experiments having demonstrated that tuberculosis bacilli destroyed by heat or other agents pass through the walls of the intestines as readily as living bacilli and are found in the mesenteric ganglions and lungs, we experimented with the object of discovering whether young animals, such as calves and kids, that had been made to swallow two doses, the second forty-five days after the first, of from 5 to 25 grammes of dead bacilli or bacilli whose virulence had been modified, could endure with impunity the injection of a meal of 5 centigrammes of fresh tuberculous matter taken from a cow, matter which would be surely infectious under ordinary conditions. We are now convinced that bovine bacilli destroyed by boiling for five minutes or simply heated during the same period will, for five months and even for a longer time to which it is not now possible to fix a limit, vaccinate perfectly against virulent infection through the digestive organs.

"We shall before long make known a detailed account of our experiments as well as others in progress, for which we have used treated bacilli from various sources and bovine bacilli treated by iodine and by hypochlorite of lime. Our belief, founded on experiments, now is that young calves may be vaccinated by a simple intestinal absorption of bacilli subjected to heat, and that this method of vaccination is not dangerous.

"If further careful experiments should justify the application of this method as a preventive against bovine tuberculosis, nothing can be urged against its application in the case of human beings. We think it will be possible to guard children against natural infection by giving to them a few days after birth, and again a few weeks later, a very small quantity of tuberculous bacilli of human and bovine origin subjected to heat and mixed with a little milk. The only precaution absolutely necessary, and one not always easy to apply, would be to guard children thus vaccinated against all tuberculous contamination for a period at least of four months. Special nurseries might be founded for new-born infants of tuberculous parents, where they might be protected against all tuberculous germs until they had acquired immunity through vaccination. We believe that these difficulties would be readily overcome in order to insure such immense advantages as those gained by rendering humanity refractory to tuberculosis contagion."

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### The World's Paper Consumption.

The Revue Scientifique recently discussed the consumption of paper by the principal nations of the world as reflecting modern progress of civilization because of its extensive use for printing purposes. It places the United States in the front rank as the greatest paper-producing country of the world, with an annual output of 639,734 tons (avoirdupois). Germany follows with an annual production of 393,683 tons, England 246,051, France 196,942, Austria 147,706, and Italy 123,026.

One American corporation is declared to be the greatest paper manufacturing enterprise in the world, possessing 31 factories with 96 continuously running machines, the company using almost as many machines as are operated in Italy and the Netherlands altogether, and its annual production exceeds that of all the paper factories in Austria-Hungary and almost equals that of all the British ones. Its capital amounts to more than $110,000,000. While America leads in production, Germany has become the largest exporter of this article, with 51,000 tons annually, England following with 49,210, the United States 16,880, and France 13,090. The United States export goes principally to South America, but also to Canada and Australia. Notwithstanding its large production England remains a good buyer, having imported 147,706 tons last year.

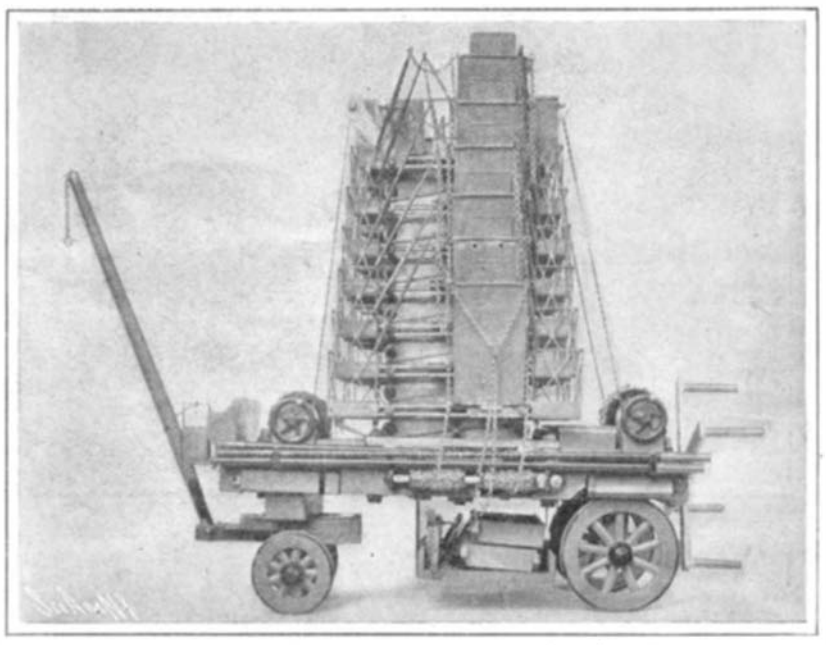
Regarding the direct consumption of paper it is an interesting fact that the United States leads with an annual figure of 38.6 pounds per capita, England coming next with 34.3, Germany 29.98, France 20.5, Austria 19, Italy 15.4, Servia showing the lowest European figure, 1.1; India shows only 0.22 and China 1.1 per capita. Nearly half of the paper manufactured in the world is used for printing purposes. Twenty per cent is absorbed in the trades and industries. Almost an equal proportion is applied for official and school purposes. The remaining 10 per cent serves the demand for private use.

### TWO RECENT FIRE-FIGHTING INVENTIONS.

Fire-fighting and life-saving apparatus have for years presented a profitable field for the inventor. Countless devices of this character have been invented and patented in all countries, and many of these are to-day in use by the fire departments of various cities. Two recent inventions on similar constructive lines and for a like purpose are illustrated herewith. They constitute, substantially, the combination of a water tower and a fire escape for persons trapped in burning buildings. In each of these apparatus the principle of the lazy tongs has been utilized in the construction of an extensible tower mounted upon a truck. The first is the invention of Wilhelm Lampé, of Baden Baden, Germany, while the second is attributable to John Holm, of New York.

In Lampé's device the portable telescopic tower, built upon a wagon or truck, is provided with extendable platforms, which can be set at different points according to the height of the floors in the burning building from which the people are to be rescued. In principle it is, roughly, not unlike the great storming towers employed by the Romans in capturing beleaguered cities. These were wooden structures provided with swinging platforms which could be pivoted outward and which, when the towers filled with armed men had been pushed against the wall, were swung outward from the side of the structure on to the top of the wall, and provided a bridge across which the besiegers could rush upon the fortifications. The similarity, however, ends with the principle of the construction, for the utilization of the later device is not for the purpose of destroying human life, but for the saving of endangered beings. Lampé's tower is provided with a double arrangement of ladders and with the necessary number of the railed extendable bridges to enable the device to be utilized at several different floors simultaneously. The platforms are mounted at the junctions of every second pair of the legs constituting the lazy tongs, and each platform is provided with a gangway reaching to the windows. The hinged platforms can be let down collectively by a single operation from a vertical position against the side of the tower, and are held horizontally by chains running from the top of the tower to the end of each. The entire framework can be collapsed into a comparatively small space upon the body of the truck which carries it. When the tower is elevated, a system of telescopic rods attached to the framework is used to steady the apparatus, the rods having their ends resting upon the ground and acting as struts or braces. The tower is raised and lowered by a system of windlasses and chains, which can be either mechanically or manually operated. The truck may be drawn by horses in the conventional manner, or, if preferred, the tower can be mounted on a motor wagon of a construction suited to the apparatus.

The invention of Holm, while similar in principle to that of Lampé, is rather simpler in construction. The truck has the usual pairs of wheels, which are independently steered and are provided with motors to drive the machine. At the center of the platform is a second motor, which by means of intermediate gearing raises or lowers the lazy tongs constituting the tower. The inner ends of oppositely projecting rods are provided with gears, which mesh with the gear of the motor, and the rods, in turn, are secured to the primary beams of the lazy tongs, which are pivotally mounted to the frame of the truck. The driving motors of the carriage, and the motor for raising or lowering the tower, receive current from storage batteries carried in the usual manner upon the body of the vehicle.



Lampé Tower in Its Depressed Position for Transport.

At the upper end of the tower is a platform provided with railings, and having gangways at the sides which may be pushed out toward the burning building to provide a bridge from the windows to the platform. At the center of the platform is a rotatable base which carries the usual fire nozzle, and which is provided with a hose leading to the body of the carriage to carry a stream of water to the nozzle. As the device is intended for service not only as a life-saving device and as a water tower, but as a fire engine as well, it is provided with a pump on the body of the carriage, by means of which powerful streams of water can be forced through the hose and nozzle. As in the device invented by Lampé, the lazy tongs of Holm's apparatus are cross-braced and stayed to insure the rigidity of the tower. Adjustable struts are mounted at the sides of the truck, and have rods which can be thrust downward upon the ground to steady the whole framework when the device is in operation.

The trucks of both designs are provided with the usual guiding mechanism, and means for braking when necessary. It will be understood that with slight modifications both could be used as movable scaffoldings in constructive work for towers, chimneys, bridges, and the like, or as observation towers for military purposes, or, for instance, as stations for heliograph reflectors, searchlights, or wireless telegraphic outfits.

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To cause paint to adhere firmly to galvanized iron, the United States government has adopted specifications compelling the use of vinegar for washing the surface preparatory to painting. This is said to roughen the surface, thus giving the paint better opportunity to adhere.

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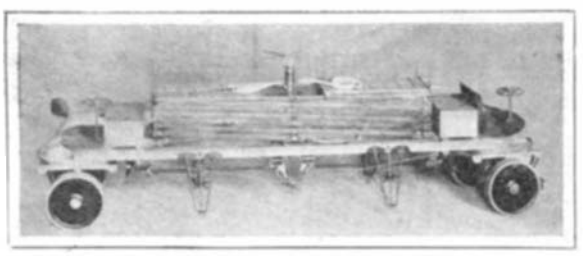
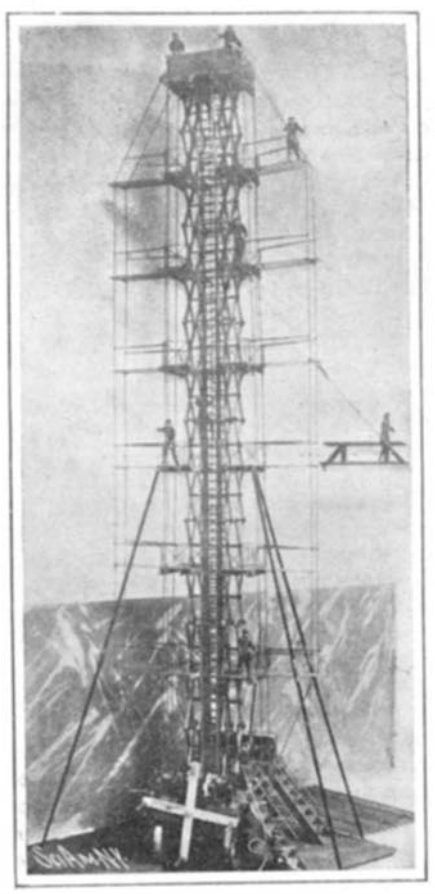
Business circles of Prague, Austria, have viewed with appreciative interest the establishment of a commercial intelligence bureau by the American consul, U. J. Ledoux, as a special department of his office. Needless to say, the object of the innovation is the closer study of market conditions and the facilitating of business connections by assuring the exchange of commercial intelligence between the countries interested. It appears that this simple application of modern business methods to modern consular duties has created no little favorable discussion in Austrian and German business circles, and promises to be productive of valuable results.

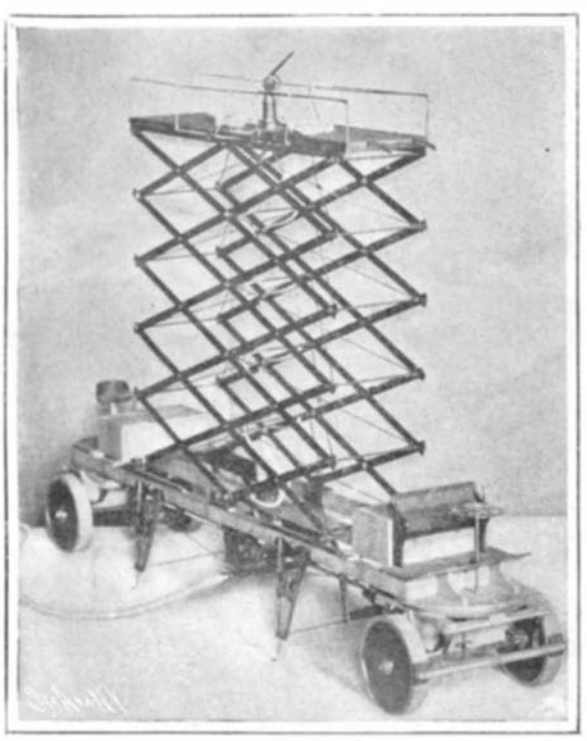
The system, which is planned primarily to obviate as much as possible the usual troublesome correspondence in seeking information or the placing of orders, is based on up-to-date methods of indexing and filing manufacturing and business information, price lists, catalogues, etc., as well as technical and trade literature. In addition, lists of exporters, importers, buyers and sellers of goods of all classes are kept on hand for reference. A special room has been provided for the uses of the Commercial Intelligence Department, and has been equipped with the best of modern business furniture. This room contains over a hundred periodicals filed on numerically indexed holders. Each publication is also alphabetically indexed on record cards, according to title and subject matter treated, while articles of special interest are likewise recorded for reference. Filing cases are provided for catalogues, price lists,



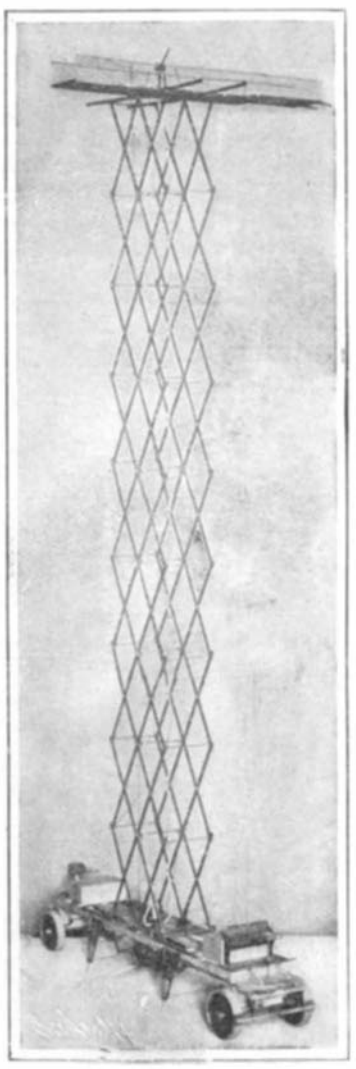
Holm's Apparatus Ready for a Dash to a Fire.



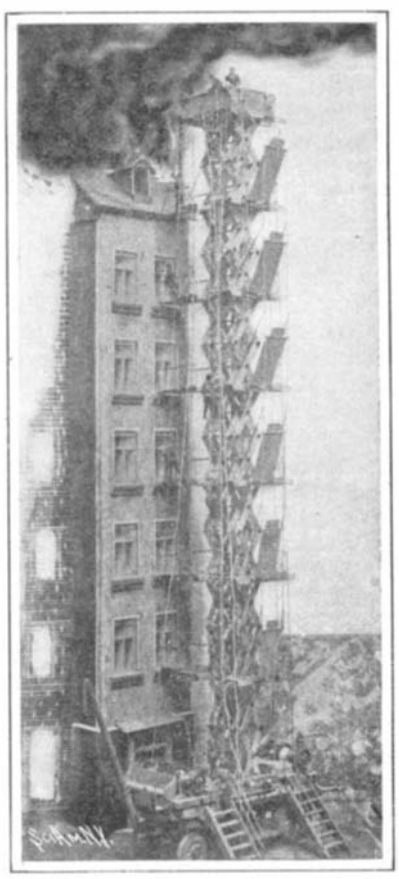
Lampé's Tower Extended With Gangways Out in Both Directions.



Holm's Tower Partially Erected.



Holm's Water Tower Extended to Its Full Height.



Lampé's Apparatus in Operation at a Burning Building.

TWO RECENT FIRE-FIGHTING INVENTIONS.

circulars, small samples, photographs, etc., while record cards of merchants, merchandise, and other important commercial data are similarly treated. Manufacturers and others here and abroad are requested to send whatever information they believe to be of value in this connection.

## MOTOR CAR FOR WHITEWASHING RAILROAD TUNNELS.

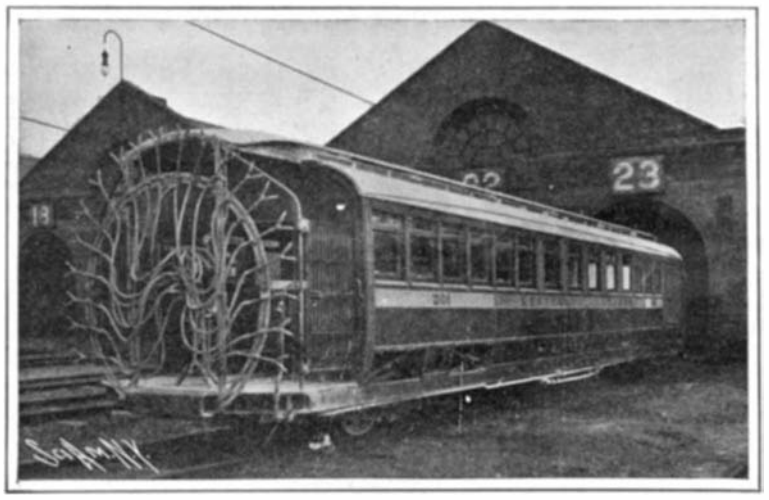
BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The Central London electric railroad runs through the heart of London to a southwestern suburb. It is constructed on the deep-level tube principle, with the up and down tracks running through separate tunnels. Although the line is only about seven miles in length, there are thus about fourteen miles of tube, irrespective of short lengths at crossovers and junctions. Because the cars are but slightly smaller in cross-section than the tunnels, it is impossible to paint the tubes in the ordinary manner. The problem is still further complicated by the fact that trains run for nearly twenty hours during the day. Painting by hand is obviously impossible. The Board of Trade, however, demands that the tunnels and rails be thoroughly examined once in the course of every twenty-four hours. During this interval the railroad authorities periodically treat the ironwork to a protective coating. As ordinary oil paint cannot be employed for the purpose, whitewash is utilized, the material being mechanically applied to the walls by a special system devised by Mr. G. C. Cuningham, M. I. C. E., the general manager of the railroad. One of the ordinary electric motor-propelled passenger coaches withdrawn from service has been converted for the purpose. In the front of the car is the driver's compartment, while at the rear end is a circular frame, from the center of which radiate in all directions a series of twenty pipes arranged equidistantly. Each of these pipes has a double branch attached to its outer end, fitted with fine nozzles. These pipes are carried out as far as possible, leaving only a space of some six inches between them and the walls of the tube, the lowest nozzle being fixed at a height corresponding with the level of the car floor, which is only a few inches above the level of the track in the tunnel.

The seats within the car have been removed entirely to make room for a large rectangular tank of eight hundred gallons capacity. This tank is filled with whitewash. From this tank extends a pipe leading to an electric driving pump, from which in turn extends another delivery pipe to a small cylinder in the center of the nozzle frame. The cylinder feeds the branch pipes.

The car is driven through the tube at a speed of about four miles an hour. The electric pump forces the whitewash through the branch pipes at the rear, distributing it in a fine spray from the forty nozzles upon the whole internal surface of the tunnel above the track level. A perfect and even coating is in this way applied. Because of the liquid state of the whitewash, only a very thin coating is deposited upon the ironwork at one time, about three applications being required to cover the walls sufficiently. Owing to the comparatively slow speed at which the car travels, every part of the ironwork is thoroughly treated, and yet at the same time the coating is not sufficiently thick to peel off.

With this device it is possible to whitewash the whole length of the tunnels with at least one coating in a single night, when the trains have been suspended. As a two-and-a-half-minute train service is in operation throughout the whole working day, the whitewashing car cannot carry out its functions during this period without seriously interfering with the traffic, so that it is brought into operation immediately the last train has completed its journey.



THIS CAR WHITEWASHES ONE OF THE LONDON TUBES.

An electric pump forces whitewash from a tank in the car through the radially-arranged nozzles mounted at the rear.

## A HUGE ARCHED YUCCA TREE.

As is well known, the varieties of the yucca plant in the Southwestern States and in Mexico are so numerous and varied in size, that some of them are exceedingly picturesque.

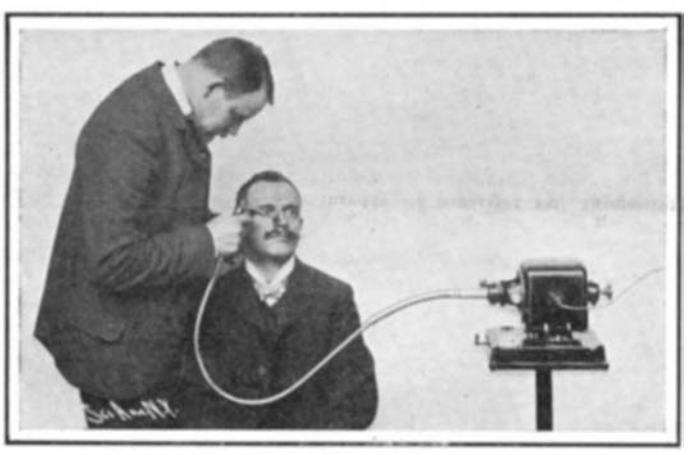
This illustration of a yucca tree in the Mojave desert gives an idea of the huge proportions to which this particular species often attains. Its lower part really forms an immense arch, the center of which is several times the height of the horse standing beneath. In fact, the distance from the ground to the highest portion of the arch is nearly thirty feet. The specimen illustrated is of symmetrical proportions in contrast with the ones seen beyond the arch, the latter being twisted into a dozen different forms. They present a striking example of the effect of wind storms on the desert, as their distortion is due almost entirely to the action of the air currents in bending them, when young plants, into various positions.

Compared with varieties of the yucca found in Florida and portions of the Southwest, the specimen shown in the illustration is truly enormous in its proportions, being really a tree in height and the size of the stem.

## A NOVEL ELECTRICAL MEDICAL TREATMENT.

BY FRANK C. PERKINS.

The accompanying illustration shows the arrangement of a new and interesting German electric motor-driven instrument for treating red noses. This instrument was designed by Prof. Lassar, of Berlin, and is said to be a most efficient means of remedying the abnormal redness of the nose, usually caused by enlarged blood vessels.



THE ELECTRICAL TREATMENT FOR RED NOSES.

By Prof. Lassar's method, a vibrator or concussion instrument is operated by an electric motor, the instrument being provided with about fifty gilded platinum points in a bundle working in a vertical direction, at a very high rate of speed. The application of this instrument causes bleeding of the skin, the pricking treatment being accompanied in some instances with a galvano-caustical or electrolytical treatment by means of special needles.

In some instances an anesthetic is used, the chlorethyl spray being employed. In most cases, however, the patients are able to endure the rapidly-repeated pricking without inconvenience. One or two treatments per week are sufficient to restore very abnormal noses to their normal color within a month without destroying the excessive blood vessels or leaving any scar. In many cases the galvano-caustic or electrolytical needles are not utilized, although they may be employed in combination with the rapidly-repeated pricking of the electric motor-driven instrument when found necessary.

AN ARCHED YUCCA TREE.

### Seaweed Burning in Norway.

Along the shores of Joderen, on the southwest coast of Norway, the seaweed grows in veritable forests; not the common grass variety, but actual trees from five to six feet in height, with stems like ropes and leaves as tough as leather. It begins to sprout in March and April, and gradually covers the ocean bed with a dense, impenetrable brush. In the fall the stems become tender, the roots release their suction-like grip on the rocky bottom, and the autumn winds wash it ashore in such great quantities that it looks like a huge brown wall along the entire coast. The fall crop is of comparatively small value. The only use that can be made of it is for fertilizing purposes, because it is only in the spring that it can be successfully burned, and at this time there is such a demand for it that every stalk and leaf is gathered as if it were pure coin.

The weed-burning season is the busiest of the year, and every member of the household is drafted to assist in gathering, drying, and burning. At the close of each clear day the whole coast seems to be aflame from thousands of bonfires that are kept burning far into the night. This is one of the many natural resources that has unexpectedly developed in Norway, and no one ever dreamed twenty years ago that this seemingly worthless weed would in a few years, as a source of income, surpass the fisheries, which have been the mainstay of the people of that country for ages, nor rival that of agriculture in one of the leading agricultural districts of Norway. Yet such is the case to-day; and those who are fortunate enough to own land abutting the seashore, can reap the most profitable crop of the year. Owners of farms located where the weed seems to have a predilection to drift can burn as much as 3,000 pounds a year, which sells for from $2.25 to $3.75 a pound. The annual income to Norway from seaweed ashes amounts to about $150,000. Every fisherman knows the difference between alga and tang. Only the former can be used as raw material for the iodine and chloriodic industry; tang is entirely worthless. But of the different kinds of alga, it is immaterial, or nearly so, whether one makes use of the large, strong stalks or the broad-leaved kind; when the weed is carefully handled, one can secure an excellent product. If tang is burned with alga the value is decreased considerably, but notwithstanding this fact the mixture is not infrequent.

After the burning the ashes are carefully gathered, packed, and shipped to all parts of the world. The subsequent treatment of the ashes is veiled in scientific mystery. They contain many valuable chemical properties among which iodine is the most important.

### An Interesting Type of Roman Villa Unearthed at Caerwent.

An unusual type of Roman villa has been unearthed on the site of the ancient Roman encampment in Britain at Caerwent. The remains have been found to be in an excellent state of preservation. A departure from the conventional practice of the Romans in the designs of their residences, as revealed by previous excavations in the country, is the provision of extra rooms abutting on the four sides of the courtyard. In the basements two completely perfect heating devices or hypocausts were found, together with the peculiar blue tiles utilized by the owners for conducting the heat from the stove in the basement and radiating it through the upper rooms of the dwelling. In the basement some exquisite specimens of Roman paving were moreover unearthed.

## RECENTLY PATENTED INVENTIONS.

### Electrical Devices.

SUSPENSORY DEVICE FOR ELECTRIC LAMPS.—S. R. BELL, Tuscaloosa, Ala. The device comprises a spring-controlled drum around which is wound a duplex flexible conductor for both supporting an electric lamp and supplying electric current thereto, electrical connections being employed between the drum and one of the terminals of each of the wires forming the conductor. An attaching member for attaching the device to a ceiling or other support is employed, together with hangers for the drum and electrical connections between fuses held by such member and the drum.

### Of Interest to Farmers.

PEA-HARVESTER.—H. M. CHISHOLM, Byron, Ga. The invention relates to improvements in machines for harvesting cow-peas. As the machine is drawn forward the stripper will be rotated, removing the pea-pods from the vines and depositing the pods into the body of the machine; and the body may be readily regulated or adjusted as to height from the ground.

DEHORNING IMPLEMENT.—S. T. WICKS, Denver, Col. In this invention the improvement is in that class of implements which is particularly adapted for dehorning calves or very young cattle and which comprises a blade, having opposite and converging cutting edges adapted to make a draw cut in removing the horn.

### Of General Interest.

METAL PROTECTING-SOLE FOR FOOTWEAR.—W. J. LINWOOD and JENNIE BENNETT, Raton, New Mex. The invention pertains to improvements in soles for boots and shoes, the object being to provide a device of this character that will be light, yet strong, and adapted to readily yield to the varying movements of the boot or shoe, and therefore not cramp the wearer's foot. Novel means secure the device to a boot or shoe.

ART OF PRODUCING MASTIC. — H. PASCHKE, New York, N. Y. The invention relates to the bituminous mastics formed and capable of employment in a cold state and without the application of heat of any sort, so that the article may be produced as expeditiously as common mortar and applied in essentially the same manner. It possesses not only the advantages of eliminating the use of heat in all forms, but also that of an entirely waterproof composition, especially useful where waterproof walls, ceilings, or analogous structures are to be produced.

PROCESS OF SMELTING COPPER MATTE.—W. KEMP, Tucson, Ariz. Ter. Mr. Kemp's invention pertains to smelting, and more particularly to a process for smelting copper matte so as to produce black or metallic copper directly therefrom. The process readily saves seventy-five per cent of the cost of the process ordinarily used in converting. It is of peculiar value to smelters who work on a small scale and who find it necessary to ship the so-called "fifty-per-cent matte." The process is done in a single operation.

EDUCATIONAL DEVICE.—R. D. MITCHELL, Sandusky, Ohio. This simple device assists a teacher in instructing a class in mathematics, particularly in addition, and saves time of a teacher in dictating problems and the student's time in writing them, it being possible for the teacher to quickly and accurately designate the boundaries of figures on a chart in columns, the figures within which columns are to be added, and for the students to locate and rule off the boundaries without injury to the chart.

HAND-BAG.—A. WIGHARD, Jersey City, N. J. In the present patent the invention has reference to improvements in hand-bags or similar receptacles, the object of the inventor being the provision of a hand-bag or the like with a combined handle and frame, thus reducing the cost and simplifying the construction.

LIFE BELT OR PRESERVER. — P. C. PETRIE and H. L. DES ANGES, New York, N. Y. This life-preserver, constructed preferably of balsa wood and treated to render it fireproof and waterproof, is thoroughly durable and serviceable. The manner of forming the straps renders them almost indestructible, by fire or weather. By extending the straps' ends down between the buoyant blocks and connecting them with the binding-wire a secure construction is produced, while the manner of fastening the belt-straps to the preserver insures retaining the strap in position, and enabling it to be readily grasped and tied by the user.

LIFE-RAFT.—P. C. PETRIE and H. L. DES ANGES, New York, N. Y. The object of the inventors is to provide a life-raft with a suspended platform enabling the occupants to stand partly submerged, thus increasing the carrying capacity of the raft and yet to permit the platform, when desired, to be connected rigidly with the raft in the plane thereof, so that the raft may be utilized in the usual manner.

TOOTH-BRUSH HOLDER.—E. J. HYDE, Spokane, Wash. Novel features permit the attachment of the holder in a vertical position on a wall or the like, adapt it to completely incase a brush, afford a transparent side wall for exposure of the brush while therein, afford spring-pressed end walls therefor that respectively serve as a lid and bottom for the holder and enable the convenient insertion and removal of the brush, provide drainage for the holder and means for ventilation for the holder to quickly dry the brush held therein.

RETORT.—P. JACKSON, Macon, Ga. The object in this instance is to provide a retort more especially designed for extracting turpentine from pine wood and arranged to permit of conveniently loading or charging the retort with the wood to insure proper destructive distillation of the wood and to allow dumping of the residue after the extracting process is completed.

BEVERAGE-SPOON.—H. MORGAN, Cripple Creek, Col. The improvement is in spoons for mixing and straining beverages such as are usually dispensed in retaurants, bar-rooms, and the like, the object being to provide a spoon that may be quickly and readily changed from mixing to straining position, thus saving considerable time in the mixing and straining of drinks.

CAMERA.—E. L. HALL, New York, N. Y. One purpose of the invention is to provide a simple and economic construction of camera wherein a prism is employed to reflect an image upon the focusing-glass and conveniently-operated means for obtaining an accurate focus by the movement of the lens-carrying section of the camera-box. The same inventor has also procured a patent on another camera, the purpose being to provide one of the type in which the shutter is connected with the focusing-mirror in such manner that when the mirror is brought to focusing position the shutter will be carried out of the focal plane of the lens and whereby when the mirror is carried up to effect an exposure the shutter is automatically carried to working position relative to the lens and is also automatically operated.

DRAWING-BOARD.—H. D. GRINNELL, New York, N. Y. The invention provides means by which a long sheet or continued web of paper may be safely held in position convenient for drawing and any part of the web or sheet exposed at will. This is done by providing a frame or board having two drums on which the paper is wound, the drums being connected to devices by means of which they may be rotated simultaneously in the same or opposite directions, thus enabling the sheet to be moved over the board and by turning the drums oppositely the sheet may be stretched firmly over the board.

ORE-CONCENTRATOR.—P. A. HARDWICK, Colorado City, Col. In the present invention the improvement has reference to apparatus for concentrating ore, and Mr. Hardwick has for his principal object the provision of an effective ore-concentrator which in this instance is especially adapted for the saving of the float values.

GAGE.—A. D. FELLOWS, East Auburn, Cal. In this case the invention refers to gages and more particularly to those adapted for use with shingling-hatchets or similar tools. Its principal objects are to provide a simple and inexpensive device which may be readily attached to the tool.

FRAME FOR FILTER-PAPERS.—A. M. VAUGHAN, Richmond, Va. The purpose of the frame is to facilitate the folding and placing of a filter-paper within a funnel. More specifically, the object is to produce a frame for this purpose which may be readily operated in applying the paper and in folding the same to conform to the shape of the funnel.

### Hardware.

BORING DEVICE.—J. PRESS, New York, N. Y. In this case the invention relates to a new and improved boring device for use in conjunction with an ordinary brace and bit to enable the operator to bore a hole at right angles with the surface of the object in which the hole is bored.

COMBINATION-TOOL.—C. NIELSEN, Middletown, Conn. The purpose of the inventor is to provide a tool especially adapted for use by machinists, but which is also of value to all mechanics, and which may be used as a scriber, a carpenter's square, a compass-gage, etc., and to so construct the tool that it will be simple, compact, durable, and economic, and convenient of arrangement and manipulation.

### Machines and Mechanical Devices.

COMPOUND SPRING-LEVER.—W. V. GILBERT, "Niton," East Wood road, South Woodford, London, England. This is an elastic or resilient device practically in the nature of a compound lever, and serves upon being actuated by one motion, as by being compressed in one direction or opposing directions from its normal condition, to impart or allow a plurality of motions in various directions and, in recovering its normal condition upon being released from said pressure or actuation, to impart or allow corresponding plurality of motions reciprocal to those caused or allowed by said actuation.

LAND-LEVELER.—J. J. JENSEN, Goshen, Idaho. The invention pertains to improvements in machines for leveling ground or land and making roads, lawns, and the like, the object being the provision of a leveler of simple and novel construction which may be easily manipulated to scrape the dirt from high places and dump it in low places.

### Prime Movers and Their Accessories.

APPARATUS FOR LUBRICATING. — M. CASTELNAU, 28 Rue de Washington, Paris, France. This invention is based on a new principle as to the lubrication of engines. This principle is characterized in the first place by a process for the plentiful and perfect lubrication of the members subjected to friction, the lubricant being applied and acting clear of any contact with the gases, steam, vapors, and the like which are at work. It is characterized in the second place by the almost total recovery of the lubricant used. It is applicable to any kind of engine or motor, and can be applied either to distributing-pistons or to driving-pistons.

### Railways and Their Accessories.

RAIL-JOINT.—W. NOLAN and C. H. PEARCE, Aspen, Col. The invention is an improvement in rail-joints. The lateral wing of the fish-plate underlies the inner end of a brace and also abuts at its outer edge against a shoulder of the tie-plate and is braced thereby on opposite sides of the brace, as well as beneath the brace, in the operation of the device. The tie-plate may be spiked down or otherwise secured to the tie, as may be desired.

STEP-HOLDER FOR CARS.—J. EDWARDS, New York, N. Y. The invention refers to running-boards or steps of street-cars, such as used usually at the sides of so-called "summer" cars. Where such cars are operated on double tracks, it is usual for the inner board or step, which is disposed over the devil-strip, to be turned up out of the way, this step being usually mounted upon pivots or hinge connections for this purpose.

### Pertaining to Recreation.

TOP-SPINNING PISTOL.—J. W. ELBRA, Cleveland, Ohio. Assignee, J. W. HENCKE, No. 3609 Park Avenue, S.W., Cleveland, Ohio. The pistol is designed to rapidly rotate the top and eject it at its muzzle. The object of the inventor is to produce a simple and effective device, harmless, easily operated, and manufactured at a small cost. It consists of a casing assembled together to simulate a pistol, having means at its muzzle to hold a top and means to be forcibly projected in the barrel by a spring when released by a trigger to engage the periphery of the top, giving it a sharp twist and at the same time eject it from the muzzle.

### Pertaining to Vehicles.

SWINGLETREE.—A. DE L. LITTLE, Gamewell, N. C. The inventor provides a swingletree in which the strain of starting a load will be relieved by the spring action, so that injury to the draft devices, as well as to the team, will be avoided, and he arranges the tension-spring in such manner as to prevent any danger of breaking or injuring the same, so that he provides an efficient and durable device at a small cost.

CAR STOP.—G. L. HOLLINGSWORTH, Silverton, Colo., patents a car stop for special use in connection with mine cars, and arranged to automatically stop the car when the latter reaches the place of dumping. The stop, which is secured in proper position on the ties between the rails, is in the form of a vertically rocking lever, one end of which is to be automatically engaged by the front axle of the car, the opposite end of the lever having a fork which receives the rear axle and prevents further forward movement of the car.

ATTACHMENT FOR ELASTIC TIRES.—W. H. VIOLETT, Piceance, Colo. The improvement of this patentee relates to a means of protecting the tires of automobiles and bicycles and preventing punctures. An auxiliary tire of thin metal encircles the usual elastic tire and is apertured for receiving in close relation plugs of special form made in attachable sections adapted to be quickly placed in position on the auxiliary tire or removed therefrom.

DUMPING-WAGON.—P. PINTO, New York, N. Y. This invention provides improvements in the class of wagons used for trucking or heavy carting in which the box or wagon body is adapted to be turned or tilted for dumping the load. The wagon body may be moved to either side when it is desired to discharge the load at the sides, or it may be moved to the rear to discharge the load at the rear.

TRUCK.—C. H. RICHARDSON, Dover, N. H. The invention refers more especially to hand-trucks for barrels, boxes, and the like, though applicable to the handling of other freight or merchandise; and one of the objects is to provide a structure of this kind which is inexpensive to manufacture, besides being strong and easily handled. Means are provided for loading and maintaining a load upon the truck and for releasing the same when desired for facilitating the unloading.

### Designs.

DESIGN FOR A CLOCK-CASE.—E. EHRLE, New York, N. Y. Mr. Ehrle has invented an ornamental design for a clock-case, which comprises at its upper part a circle or case surrounded by scroll work of very graceful lines, and supported by nude figures of two boys posed in the lower scroll work.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

## Business and Personal Wants

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

**MUNN & CO.**

Marine Iron Works. Chicago. Catalogue free.

**Inquiry No. 8424.**—Wanted, power looms for weaving wire cloth.

For mining engines. J. S. Mundy, Newark, N. J.

**Inquiry No. 8425.**—Wanted, name and address of the manufacturer of the Rose automatic knife and razor grinder.

"U. S." Metal Polish. Indianapolis. Samples free.

**Inquiry No. 8426.**—Wanted, manufacturers of cast steel hooks and eyes for connecting leather and hide rope banding.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

**Inquiry No. 8427.**—Wanted, names of parties engaged in preparing seal skins for shipment.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

**Inquiry No. 8428.**—Wanted, manufacturers of heavy screw presses, also screw jacks and screw punches.

I sell patents. To buy, or having one to sell, write Chas. A. Scott, 719 Mutual Life Building, Buffalo, N. Y.

**Inquiry No. 8429.**—Wanted, manufacturers of hand heaters employing slow combustion fuel.

Metal Novelty Works Co., manufacturers of all kinds of light Metal Goods, Dies and Metal Stampings our Specialty. 43-47 S. Canal Street, Chicago.

**Inquiry No. 8430.**—Wanted, manufacturers of a newly invented rotary gas engine of 8.2 h. p., the cylinder being contained within a 12-inch flywheel.

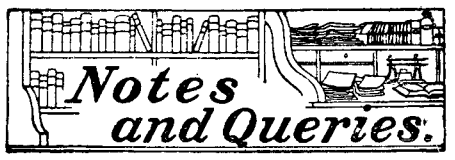
The celebrated "Hornsby-Akroyd" safety oil engine. Koerting gas engine and producer. Ice machines. Built by De La Vergne Mch. Co., Ft. E. 138th St., N. Y. C.

**Inquiry No. 8431.**—Wanted, a machine for making tamales.

**Manufacturers of patent articles,** dies, metal stamping, screw machine work, hardware specialties, machine work and special size washers. Quadriga Manufacturing Company, 18 South Canal St., Chicago.

**Inquiry No. 8432.**—For manufacturers of floor scrapers and smoothing devices.

**Inquiry No. 8433.**—Wanted, a machine, similar to a typewriter, for the use of the blind, for writing musical scores.

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**Names and Address** must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

**References** to former articles or answers should give date of paper and page or number of question.

**Inquiries** not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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A Reader asks a question, but does not even give his place of residence nor date his letter. He is respectfully requested to read the first Hint which stands at the head of the Query Column every week. Although the statement is perfectly plain in meaning, we yet receive every week more than one letter without name or address.

(10182) H. C. D. asks: Being a constant reader of your valuable paper, I take the liberty of asking you to kindly inform me through your Notes and Queries column whether the following statements which appear in the Encyclopædia Britannica (vol. xi, pages 66 and 67) are correct. Under the heading "Gravitation," paragraph 2, it says: "Movement of a Falling Body.—Our knowledge of the force of gravitation being ultimately founded on observation and experiment, it will be convenient at this point to describe the experiments by which a knowledge of the laws of motion of a falling body may be ascertained. We shall first describe these experiments, and then we shall discuss the laws to which we are conducted by their aid. A beginner is apt to be surprised when he is told that a heavy and a light body will fall to the ground in the same time if let drop from the same height. Yet nothing can be easier than to prove this important fact experimentally. Take a piece of cork *in one hand* and a bullet *in the other*, and drop these two objects at the same moment from the same height. They will reach the ground together. Nor will the results be different if we try a stone and a piece of wood." On page 67 it says: "The various experiments to which we have referred suffice to establish the very important result that the time occupied by a body in falling to the surface of the earth, if dropped from a point above it, is independent of the mass of the body as well as of the materials of which the body is composed." I always understood it to be a well-known fact that the velocity of falling bodies depends upon the specific gravity and the density of the medium through which they pass, and I am therefore at a loss to understand the meaning of the paragraph referred to. That the above para-

graphs cannot possibly refer to bodies falling in a vacuum seems to be shown by the sentence: "Take a piece of cork in one hand and a bullet in the other, and drop these two objects at the same moment from the same height." A. The article which you quote from the Encyclopædia Britannica was written by Prof. Ball, Astronomer Royal of Ireland at the time he wrote it. It is hardly likely that he was in error on so simple a matter as the fall of a cork and a bullet from the hand to the ground. Have you tried it for yourself? Had you done so, you could hardly have written the letter to us. The experiment is simple. So are others given by Prof. Ball. Try them till you are convinced that it is the matter of the earth which draws bodies down to its surface, and that the rate of fall is not dependent upon the weight or the density of the body falling. This was demonstrated by Galileo at the Leaning Tower of Pisa before the immortal demonstration of the law of gravitation by Newton. The paragraphs you refer to have no dependence upon the other fact that the lightest and heaviest bodies fall alike in a vacuum. They refer to the fact that all moderately heavy bodies fall practically alike through the air. Very light things are retarded enough by the air to have their rate of fall changed by the resistance of the medium through which they are falling.

(10183) H. M. asks: 1. Why are the guns on battleships not larger than 45 caliber, 12-inch? Is it because they are strong enough, or because an ordinary ship is unable to carry larger guns? A. 45 calibers is found to be the maximum length which can be used to advantage for the 12-inch gun. The greater length would prove cumbersome, and necessitate larger turrets to accommodate the greater weight back of the trunnions. 2. By what formula is the displacement of ships known before they are launched? A. The displacement of ships is found by calculating the cubical bulk of the ship below the water-line. 3. Would it be possible to build torpedo boats of say 400 tons with a speed of 45 knots? A. In the present state of the art it would be impossible to build a hull of 400 tons displacement which would float horse-power necessary to give a speed of 45 knots. The "Viper," a torpedo boat of slightly over 400 tons, holds the record for speed of slightly over 36 knots an hour. The horse-power increases as more than the cube of the speed, and hence the weight of the engines to give a propeller thrust suitable for a speed of 45 knots would be altogether prohibitive. 4. a. A description of the 21-inch torpedo in use in the United States navy. A. The United States 21-inch torpedo was described in the SCIENTIFIC AMERICAN of January 6, 1906. b. A description of the 45-centimeter torpedo in use in the German navy. A. We are not aware that any data regarding the German 45-centimeter torpedo have been made public. 5. Is there any work giving complete statistics of all rapid-fire guns in use in the large navies? A. Brassey's Naval Annual gives full statistics. 6. Please put an article in your paper that treats of the new ships now building in England, i. e., "Dreadnought," armored cruiser "Orion," T. B. destroyer "Afridi," and the special type torpedo boat that is intended to make 36 knots per hour. A. The "Dreadnought" was illustrated and described in the issue of the SCIENTIFIC AMERICAN of August 25, 1906. We have no data respecting the other vessels mentioned.

(10184) E. R. asks: Will you please state in your query column how many revolutions the earth makes in 365 days? A. The earth makes 366 revolutions on its axis in 365 solar days. One rotation of the earth on its axis is completed when a star which was due south last night is to-night in the same position. Since the earth is also moving in an orbit around the sun, the star seems to reach the south point about four minutes earlier each night than it did the previous night. The earth must turn on its axis about four minutes of time more to bring the sun to the same place day by day. This extra time constitutes the difference in length between the solar and the sidereal day, and in a year causes that there shall be one sidereal day more than there are solar days. There are 365 solar days and 366 sidereal days in each year. The sidereal day is the true measure of the rotation of the earth on its axis with reference to a star or to a fixed point in absolute space.

(10185) H. B. C. asks. 1. Why is it that a light, when put into a 110-volt circuit, will not short-circuit the current, while a piece of small copper wire of about the same length as the filament of the lamp, when placed in the same position, will immediately short-circuit? I have found it to be a fact that when an incandescent light's globe breaks, the filament does the same as the piece of copper wire, provided, of course, that the current is on. Do I not, therefore, have reason for thinking that the air has something to do with this? A. When the globe of an incandescent lamp breaks, the hot filament is instantly burned by the oxygen of the air just as any other piece of carbon would be. The current is not short-circuited by the filament. The flash of light which is seen is due to the chemical action of burning the filament, and not to any electrical action. When the circuit is bridged by a short copper wire, the resistance of the copper wire is small and a large flow of amperes takes place, which heats and melts and also burns the copper. This is what is meant by a "short circuit." 2. How may a small, practical, 110-volt current electric heater be made? Is not German silver wire the best for this purpose? A. If you want an electrical heater which may be attached to a lamp socket, wind about 200 to 220 ohms of fine German silver wire on porcelain tubes and mount in some convenient fashion. SUPPLEMENT 1112, price 10 cents, contains valuable data concerning electrical heaters. 3. What is the smallest size of wire allowed by the Fire Underwriters' Association for wiring building with 110-volt current? I have been using what is known as No. 14 rubber-covered for my outside, and No. 14 weather-proof for my inside wiring. In this am I meeting the requirements or not? A. No. 14 wire is allowed by the Underwriters to carry 12 amperes in rubber insulation, and 16 amperes in other insulations. 4. Do wires necessarily need to be soldered in joining them to make them more electrically and mechanically perfect? A. In good work wires are always soldered at junctions to other wires. No other connection is allowed.

(10186) J. C. B. says: 1. In what probable way does Edison expect to utilize cobalt? Can he use the chlorine gas from it as a motive power? If not, how to use it in storage batteries? A. We regret to say that we are not able to answer your inquiry, "In what probable way does Mr. Edison expect to utilize cobalt?" etc. It would be a hazardous thing to attempt to tell what Mr. Edison will probably do, or may be expected to do. We doubt if he tells any one, even if he knows himself, what he expects to do. We may say that there is no chlorine in cobalt, and no motive power in chlorine. We are sure that Mr. Edison does not expect to find either of these results in his investigations. 2. In antebellum days here in North Carolina, by rubbing a pocket knife blade across the *points* of the old flat strap iron on the railroad track, the blades of the knife so rubbed became highly magnetic, capable of lifting iron or steel objects of considerable weight, a fourpenny nail or larger perhaps. I have so done often myself, but after some forty years cannot say positively I raised anything heavier than a fourpenny nail. Have tried the present T-iron rail repeatedly, with *no magnetism resulting* at all. Why is this? The magnetic properties were then well known, but do not know if I can *now* establish the fact by another witness than myself. A. Any magnetizing of a knife by stroking it on a rail was due to the fact that the rail was a magnet. If the old experiment cannot now be repeated, it is because the present rail is not a magnet. 3. From what source does the ocean derive its intense saltiness, and how retain same in uniform strength? A. The salt now in the ocean has been in the past ages washed out of the land or dissolved from beds of salt in the earth to which the water gained access. The saltness remains, since all the water which evaporates from the ocean is fresh water. The original water was fresh. It became salt by dissolving salt from the earth. 4. Why are the conventional number of guns (21) fired in honor of the President of the United States? Is it by Congressional enactment? Why 21 and not 13 for original in thirteen States? A. The firing of 21 guns as a salute for the national flag, the President of this or other countries, or the sovereigns of foreign states, is an international custom.

(10187) O. B. writes: 1. There seems to be an idea that artificial ice does not keep so well as natural. Is there any truth in the statement? A. Artificial ice frozen rapidly is not usually as dense as natural ice, which forms slowly and rejects the contained air more completely. The air can be seen in a cake of artificial ice in the middle of the cake. When artificial ice melts, it separates into prismatic pieces, because of its less density. These features of artificial ice seem to us to account for the impression that it does not keep as well as natural ice, that is, that it has not so great cooling power by the cubic foot as natural ice. A pound of artificial ice should be equal to a pound of natural ice. 2. In winter in the north temperate zone, in fact everywhere north of the equator, the sun shines at sunrise and sunset on north sides of houses that face due south. Has refraction of the sun's rays anything to do with that fact? A. Your second query reads as follows: "In winter in the north temperate zone, in fact everywhere north of the equator, the sun shines at sunrise and sunset on north sides of houses which face due south. Has refraction of sun's rays anything to do with the fact?" We do not understand the fact to be as you state it. At the autumnal equinox in September, the sun rises in the east and sets in the west the world over. In that position the sun's rays at rising and setting would glance along the north and south sides of a house which faces south. The same is true at the vernal equinox. From September 22 till December 22 the sun moves to the south, till on the latter date in your latitude it rises about 29 degrees south of the east point and sets the same distance south of the west point. It is obvious that its rays cannot in these positions shine on the north sides of houses which face south. Refraction could not produce any such effect as this. It changes the apparent position of the sun on the horizon about the diameter of the sun, or about a half degree; more exactly, 34 minutes of arc.

## NEW BOOKS, ETC.

DICTIONARY OF ENGINEERING IN ENGLISH AND SPANISH. By Andres J. R. V. Garcia. New York: Spon & Chamberlain, 1906. 32mo.; pp. 150. Price, $1.

The user will find some 3,000 technical terms in this little dictionary. The author provides two indices, one in Spanish and one in English, and the former will be found specially valuable in translating from Spanish into English. The English index has been made as complete as possible without causing it to become too voluminous. The book is well adapted to satisfy the demand for an up-to-date technical dictionary of the terms in general use by engineers using one or the other language.

ILLUSTRATED TECHNICAL DICTIONARY. Vol. I. Compiled by K. Deinhardt and A. Schlomann, Engineers. New York: McGraw Publishing Company, 1906. 16mo.; pp. 403. Price, $2.

This is the first volume of the American edition of a series of technical dictionaries prepared by K. Deinhardt and A. Schlomann, eleven volumes being in contemplation to give successively the industries of electricity, steam, hydraulics, mechanical handling of railways, bridges and structures, metallurgy, architecture, and naval construction. The dictionary is published on a new plan, and one that appears more nearly to meet the numerous requirements of thorough technical work of this character. The main feature is the classification whereby related subjects are brought together, the reference to any particular subject being obtained through a general index of the terms for all the languages covered. These are six in number. In addition to the German, English, French, etc., terms, the symbol or illustration of the term is frequently given. The work seems carefully prepared, with few typographical errors, and should be found useful by engineers and other technical men. The present volume treats of titles used in metal and wood work, drafting and general terms, machine design, and general machine-shop terms.

CATECHISM ON PRODUCER GAS. By Samuel S. Wyer, M.E. New York: McGraw Publishing Company, 1906. 24mo.; pp. 42. Price, $1.

The author utilizes the effective question and answer method for imparting considerable valuable information regarding producer gas and its manufacture. Both the questions and the answers, 287 in number, are concisely and clearly stated. The catechism will doubtless be found useful by engineers as well as non-technical men interested in this subject.

DIRECTORY OF THE ALUMNI OF STEVENS INSTITUTE OF TECHNOLOGY. Hoboken, N. J.: Stevens Institute Alumni Association, 1906. 32mo.; pp. 132. Price, 50 cents.

This booklet should prove useful not only to the large number of Stevens alumni, but in general to any one desiring the services of an engineer or technical man. The first part of the text comprises an alphabetical list of the graduates of the Institute, with reference to the following pages upon which these names will be found. The alphabetical list is followed by a geographical list with county and State divisions and urban subdivisions. This is followed by a geographical list of countries, including foreign residents. The fourth and main subdivision of the book comprises a business directory, in which the alumni are grouped under the various industries in which they are actively engaged.

ELECTRICITY OF TO-DAY. Its Work and its Mysteries. By Charles R. Gibson, A.I.E.E. Philadelphia: J. B. Lippincott Company, 1907. With 39 illustrations. 16mo.; pp. 344.

In this book Mr. Gibson has given us a popular account of electricity as it is applied in everyday life. In spite of the fact that he has avoided the use of technical language, he has been able to discuss the various subjects which have fallen within the scope of his book with a fair amount of thoroughness. Among the more important topics which are discussed may be mentioned electricity in medicine, electric traction, electric heating and cooking, electro-chemistry, electricity from heat, lightning, telegraphing with and without wires, electric measurements, theories of electricity advanced by modern thinkers. The book is excellently printed and well illustrated.

THE MANAGEMENT OF ELECTRICAL MACHINERY. By Francis B. Crocker, E. M., Ph.D., and Schuyler S. Wheeler, D.Sc. New York: D. Van Nostrand Company, 1906. 12mo.; pp. 223. Price, $1.

The simple directions and useful hints for the management and practical utilization of dynamos and motors contained in this book of Drs. Schuyler and Wheeler first appeared as a series of articles in the Electrical Engineer some fifteen years ago. The arrangement is so that the different subjects are treated separately and in proper order, with headings of heavy type to facilitate reference to the subdivisions. The volume is intended to be simply the basis of a more elaborate treatment of the subject in a future work, but as such will be found of value. The present edition is, of course, brought up-to-date in all its phases.

POLYPHASE CURRENTS. By Alfred Still. New York: Whittaker & Co., 1906. 12mo.; pp. 352. Price, $2.50.

The use of polyphase alternating currents for the transmission and distribution of electric power is becoming so extended, that the present volume should prove a welcome addition to the literature of the subject. The book treats in a non-mathematical way of the theoretical considerations involved in polyphase work. Practical engineers and students without the necessary mathematical knowledge required for the study of more advanced works will find the text and illustrations of value in obtaining a clear and comprehensive knowledge of the subject. The non-mathematical treatment of polyphase currents has been made possible to a large extent by the author's extensive use of graphical methods.

PERPETUAL CARE IN AMERICAN CEMETERIES. Reprinted from Park and Cemetery and Landscape Gardening, with additions of criticisms, and forms of contracts used by different cemeteries. Chicago: R. J. Haight, 1906. 12mo.; pp. 62.

LAYING AND FINISHING HARDWOOD FLOORS. By Frank G. Odell. New York: David Williams Company, 1906. 12mo.; pp. 50. Price, 50 cents.

# INDEX OF INVENTIONS

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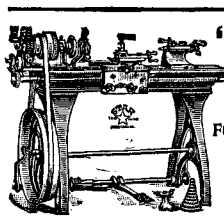

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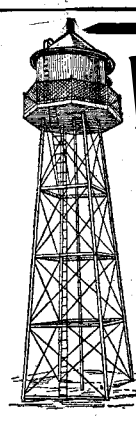

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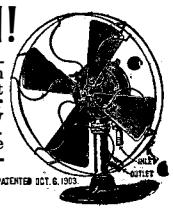

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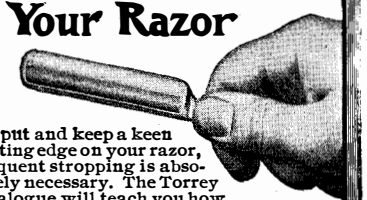

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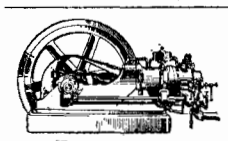

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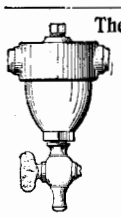

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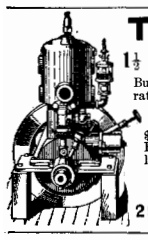

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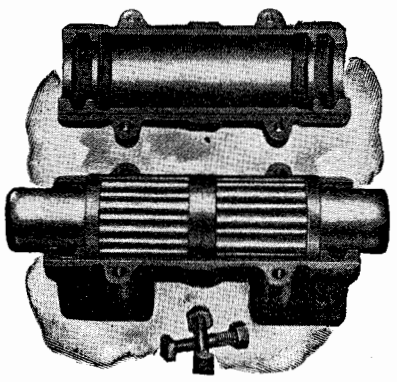

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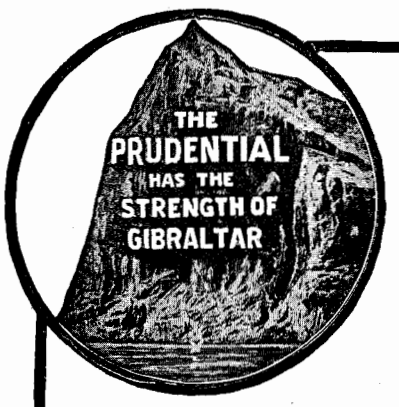


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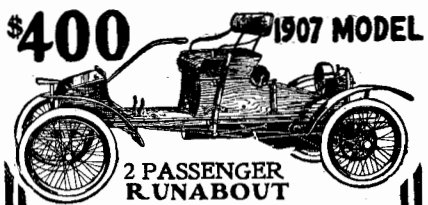

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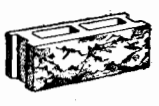

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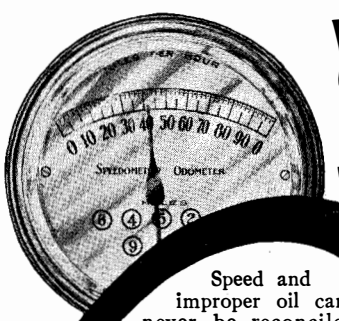

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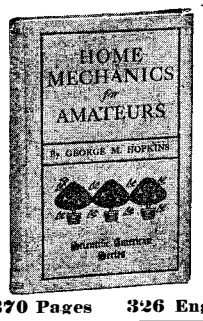


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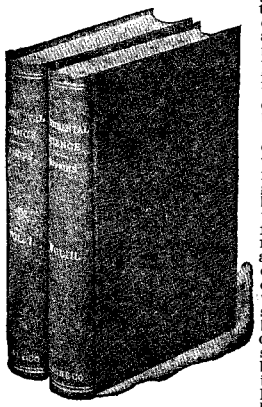

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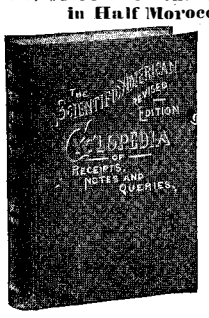


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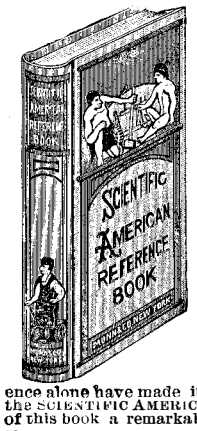


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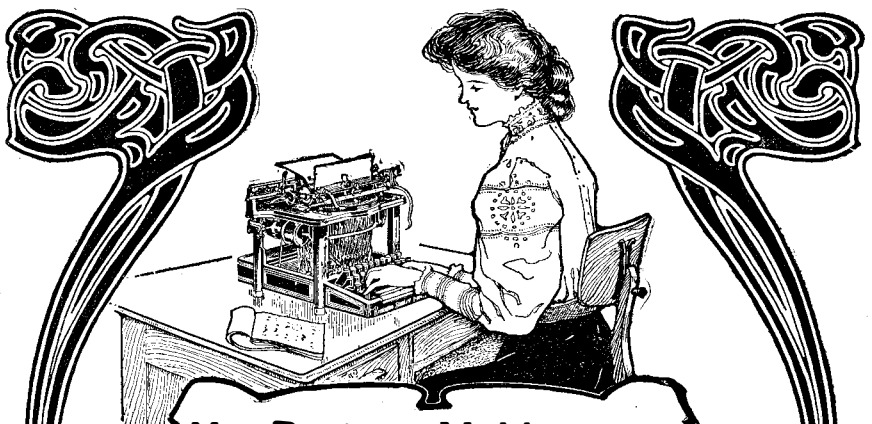

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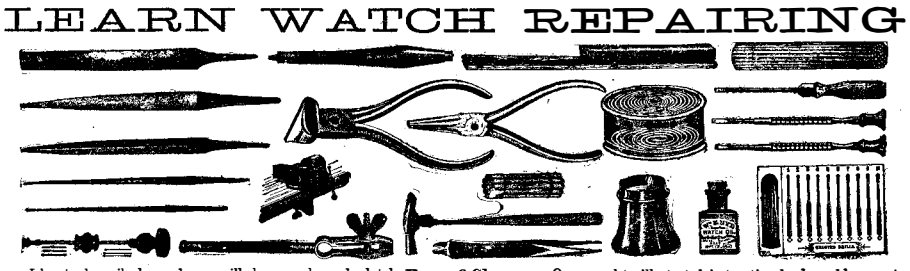

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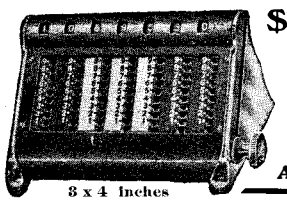

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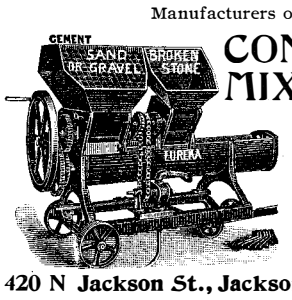


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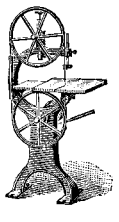

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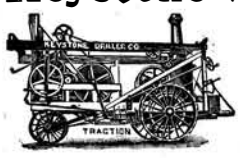


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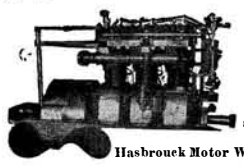

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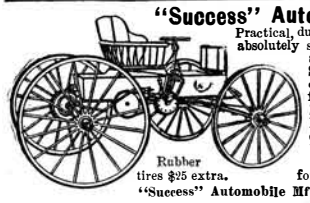

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TRUTH can be weighed, measured and figured up. That's why we dare to start right out to talk about a 1,000 per cent. investment. It may sound like fiction but it is a fact. It's as true as it is tempting, and we prove it. The Bartell Candy Cotton Spinner is one of the most remarkable applications of industrial machinery which science has yet accomplished. The machine practically cannot get out of order. It makes an old kind of candy in a new way and a better kind in a better way than has previously been discovered. The whole operation of manufacture is in open view. You see the pure granulated sugar poured into the top of the receiver, quickly melted in the rapidly revolving bowl, and frothed up into feathery filaments by swift centrifugal motion. It takes just ten seconds to turn a pound of pure sugar into a bushel of pure candy. **The Candy may be of any color and any desired flavor.** It may be plain candy or a delicate confection of nuts or fruits. To see the candy is to want it. You want to taste it because it looks so good. Then you want to buy it because it tastes so good. It is like no other sweetmeat. *It's a sort of glorified candy which fairies might spin but which gross human fingers would mar by a touch.*

Purity stamps every step of the manufacture. Pure white sugar is poured into a bowl and is changed into pure candy before your eyes without the touch of a contaminating figure. It's all done by turning a handle once every five minutes, gas or gasolene heat cooks the sugar and the machine spins the candy.

No skill is required to operate the machine. Any intelligent girl of fifteen years of age can run it, even without instructions, if you will give her the sugar. What appears to be a miracle is the proper combination of sugar, machinery and heat.

**TWO FEET OF SPACE DEVOTED TO THE BARTELL CANDY SPINNER WILL MAKE MORE MONEY THAN THE ENTIRE SODA FOUNTAIN OR CANDY COUNTER.**

No merchant will fail to admit that where crowds are attracted to their stores for any advertised article, they usually purchase other goods. Thus when you place this machine in the store of a merchant and he sees the immense crowds attracted by the novel exhibition, and the large profits taken in, not only from the sale of candy but from other goods, he will not be likely to let his competitor even have a chance to purchase one of the machines.

**INDUCEMENTS TO AGENTS**

The Bartell Candy Machine making Cotton Candy presents many possibilities to the buyer, as a money maker. The percentage of profit from the operation and sale is enormous, as it is noted below. Aside from this proposition, the machine can be sub-let for short periods to retail stores for advertising purposes, where at a very small cost the candy could, if desired, be given away.

For decorative purposes the output can be made in any color and can be successfully used for decorating banquet halls, drawing rooms, Christmas trees, etc.

It's an all year round proposition, not being limited to any season.

Considering it from a money-making standpoint, on the basis of one machine to every twenty thousand people, anyone, after seeing the novel feature of candy being made from dry sugar in one second (with the added feature of absolute purity and delicious taste), will agree at a very conservative estimate, one ten cent package should be sold to each person of the twenty thousand, as where some will be missed others will buy the candy a number of times, as has been demonstrated in different parts of the country, and sales of the 10, 25 and 35 cent packages are large. Thus you will see that you have, on the most conservative estimate, a one thousand dollar sale during the first three months from one machine.

**ESTIMATE OF PROFITS**

The following is based upon results from one machine at Dreamland Park, Coney Island, June 12, 1904, between the hours of 11 A. M. and 11 P. M.:

| | | |
|---|---|---|
| Cost of boy to run machine | $0.75 | |
| Girl to bag and sell | 1.00 | |
| Sugar, 105 pounds at 5 cents | 5.25 | |
| 4,500 bags at 47 cents per M. | 2.12 | |
| Flavoring extract | .35 | |
| Rent per day | 1.50 | |
| | | $10.97 |
| Sold 4,590 packages at 5 cents | $229.50 | |
| Less material and expenses | 10.97 | |
| | $218.53 | |

This business did not vary $5.00 or $10.00 during good weather all season, and is easily the biggest money producer that can be found for Parks, Fairs, Church Carnivals, etc. If you want a mint, if you want to get hold of something that will yield you the largest profit ever reached by any concessions, get a BARTELL COTTON CANDY MACHINE. Read the terms carefully; it is a bonanza:

| | |
|---|---|
| Price of machine complete | $162.50 |
| Machine with gas attachment only | 150.00 |
| Gasoline attachments, extra | 12.50 |
| Electric motors, extra | 12.50 |
| Stands | 5.00 |

**Twenty-five dollars with order to guarantee express charges when machines will be shipped C. O. D., with privilege of examination if desired.**

**New York Exchange or P. O. Money Order must accompany all orders. ORDERING OTHERWISE WILL CAUSE DELAY.**

**Weight of Machine, 45 lbs. Empty Box, 45 lbs. Other Materials, 35 lbs. Shipping Weight, 125 lbs.**

Order direct or through importer. Prices F. O. B. dock, New York.

When we say machine complete, we mean constructed with our outfit and attachments as follows: For gasoline, tank, with brass valve connections, pipe connections with gasoline tank with valve to operate the flow of gasoline properly; a pint can of oil for machine, a small oil can, 1,000 paper bags and enough flavoring, coloring and sugar to take in $200, a sugar pourer, screw drivers, wrenches, bolts, washers, nuts, etc. The full directions come with every machine, describing in detail just how to set up and operate properly, and formulas for making all kinds and colors of candy.

*Machines are sold with no restrictions to territory.*

## BARTELL FLOSS CANDY MACHINE CO.

**1541 BROADWAY, NEW YORK**

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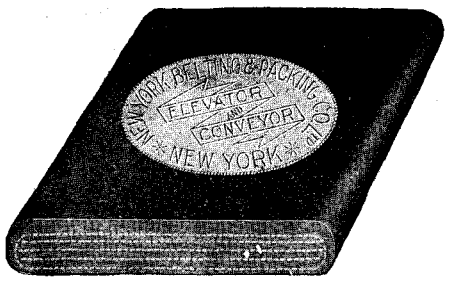


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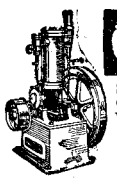

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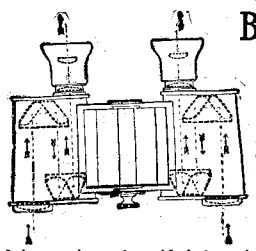

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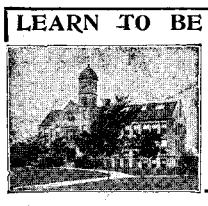

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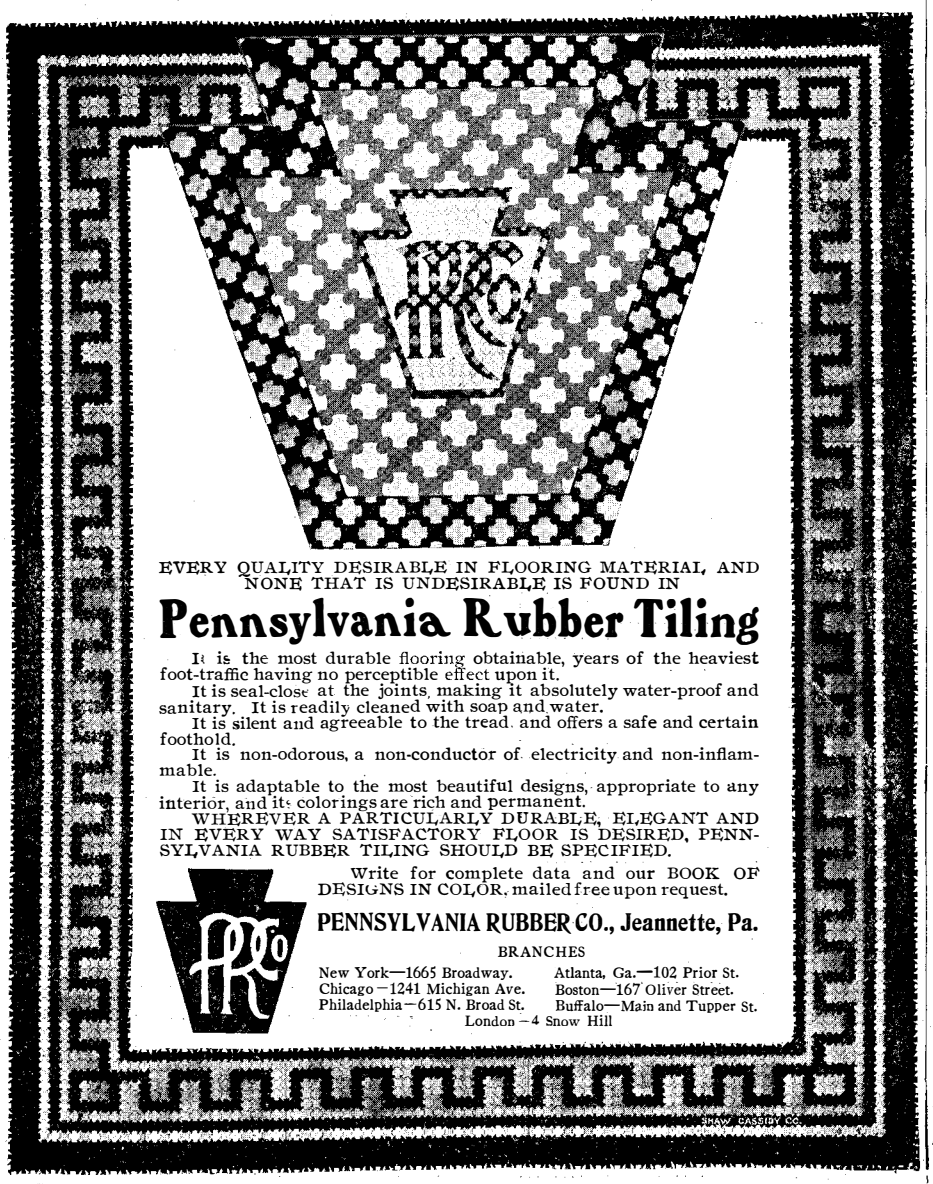

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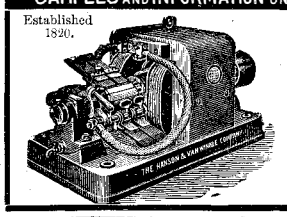

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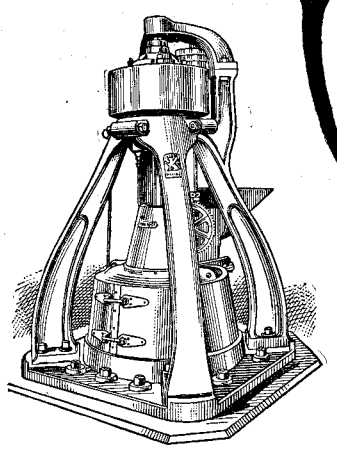

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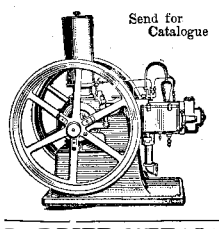

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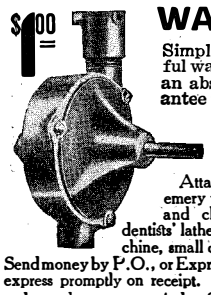

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